MACHINE DESIGN

PARTS • MATERIALS • METHODS • FINISHES

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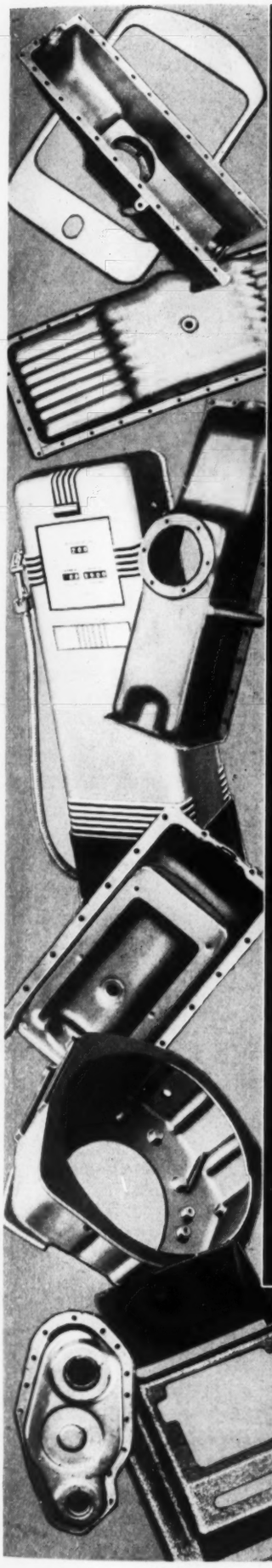

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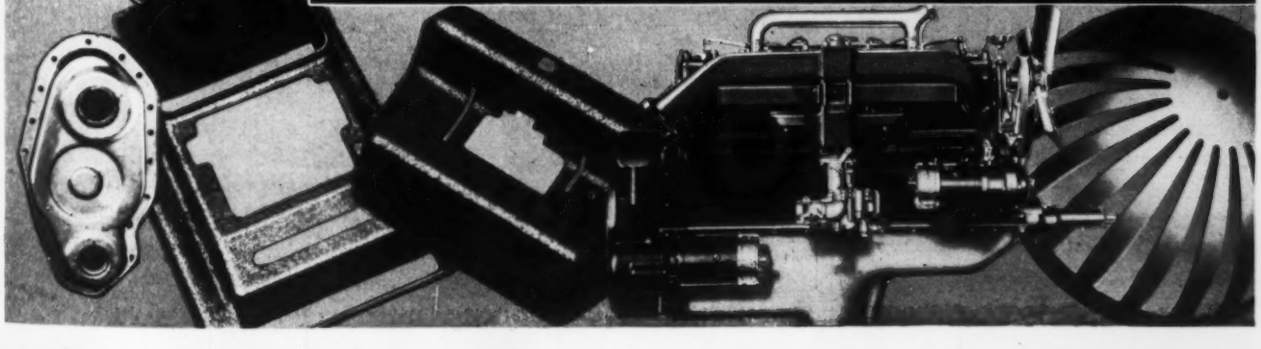


TOPICS

GASOLINE which will increase the power of internal combustion engines tremendously will be available at reasonable prices before long. Two years ago this fuel sold at $25 a gallon, but refineries are shaving the price daily. Army engineers have been experimenting for the past few years with the gasoline which has a 100-octane rating. Developed principally for aviation use, engineers have found that it will perform wonders in the conventional auto engine. Because of its exceptional antiknock characteristics, a stock model 1936 auto engine could be equipped with a supercharger, resulting in a 71 per cent power increase. A two-motor transport plane would consume 12 gallons less of the fuel per hour which would amount to a considerable saving on a coast-to-coast flight. Designers are taking note of this gasoline because any engine utilizing a fuel with the slow-burning characteristics inherent with high octane rating must be redesigned with a higher compression ratio.

◆ ◆ ◆

Water has been about the only medium used for reducing friction of rubber. Lubrication of rubber parts in machines has presented a troublesome problem as it is usually not practical to use water, and ordinary lubricants soften and destroy the rubber. Recently a patent was issued to Acheson Colloids Corp., Port Huron, Mich., for a composition, of which colloidal graphite is an important constituent, which may solve the problem. It is found that this new composition affords effective and lasting lubrication of rubber mechanical elements without harming the rubber.

◆ ◆ ◆

Rubber finds new uses in machines and for appliances every day. One particular application which we believe will make many people happy is the use of synthetic rubber for gasoline station pump nozzles. It seems as though station attendants have practiced to create a great clatter and banging when inserting the heavy brass nozzle in one's gas tank. We have often been certain that our spare tire was being torn from its holder or at least a fender was being kicked in, only to find the attendant was inserting the hose nozzle carelessly. This new flexible nozzle will not only allow the attendant to thrust the tube well into the tank, but will certainly improve relations between the customer and himself.

◆ ◆ ◆

Developments in paints in the past few years have been extraordinary. Quick-drying lacquers easily sprayed are available in every hue. Enamels which almost simulate porcelain for hardness and durability are being sold in ten cent stores. But in these developments, the changes have been principally in the manufacture of the paint rather than the use of new elements. In 1927 Swiss chemists began experimenting with a new organic compound and as a result of their studies a new blue pigment has been evolved. This discovery is the first new blue pigment in 100 years and the first blue in history fast to light, heat and most chemical reagents, according to the Research Laboratories of Interchemical Corp. Known as Syan blue-B, it is now being used in the manufacture of industrial finishes, lacquers and enamels. It is said to be ideal for automobile finishes where alkali resistance and a non-fading, brilliant blue are required. As lacquers revolutionized many painting operations so may this new pigment be responsible for a higher grade of machine finish.

◆ ◆ ◆

Musicians have lost many a job in the past decade because of machine made or "canned" music. Now it seems that even the bugler is forced to retire in favor of mechanical bugling. At Mitchell Field, N. Y., a phonograph has been adapted with crystal pickup and loud speaker to simulate the tones of a bugle which had been used to announce departing airplanes. It is a great improvement over the human bugler for its volume is almost unlimited and it is always ready for service!

MACHINE DESIGN

How Design Is Developed in Soviet Russia

By A. M. Wasbauer

NO BUSINESS activity in the U.S.S.R.—not even machine design—can escape the attention of the State Planning Commission (Gosplan). Machine design has its trust and its norm to accomplish within the yearly and five-yearly plans, but being a creative art, it is not easy to set other than a general goal to be attained. Therefore, although machine design bureaus for the various industries are given a definite norm by the Commissariats for light and heavy industries, they are allowed a wide margin of initiative in research and in the development of new ideas.

For instance, the machine design bureau known as "Experimental Scientific Research Institute for Machine Tools" (ENIMS), in addition to the tasks set by the trust "Stanko Instrument," is free to make contracts with other bureaus or manufacturing units of heavy industry for the development and design of special machinery. These designs, once acquired, can in turn be sold to other units of industry which desire to use them. Profits thus earned by the design bureau are placed to its credit in the State Bank, and these funds can be used by the direction of the bureau either to enlarge its activities and facilities or for the benefit of its workers.

Each design bureau comprises two distinct groups: A scientific staff and an engineering staff. These two control research and design, respectively, and are housed on the same premises. The research staff collects a vast fund of information for the guidance of the designer. Its aim is to keep itself posted on all new developments affecting the industry, not only in the U.S.S.R. but also abroad. It canvasses regularly all foreign trade literature and catalogs and writes voluminous, critical reports of its findings. This mass of information determines the salient features of proposed designs and when the work is finally undertaken, all such problems as feeds, speeds, capacities and mode of operation, have been thrashed out. Thus the designer is held within close confines of conception.

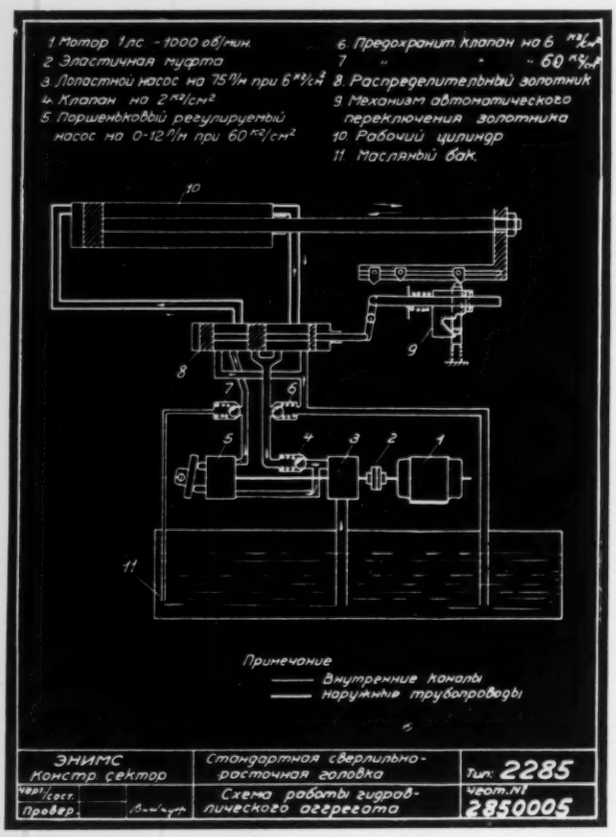
In practice, however, this system does not work out quite as smoothly as one might infer from the foregoing. For one thing, a rule of the bureau is that each design must be accompanied by one or two corollary designs, or as they are called there, "variants". Not infrequently some features of design have become obso-

ONE may not agree with Russian ideology but, even so, engineering activity in the U.S.S.R. cannot be ignored. In this article the organization, method of evolving design, salaries and other pertinent subjects relating to design in Russia are discussed. Mr. Wasbauer held the position of consulting engineer with the Experimental Scientific Research Institute for Machine Tools in Moscow for six years after being associated with a number of American machinery manufacturing companies in engineering capacities

lete abroad by the time the design and its variants appear in the form of complete assembly drawings. However, this does not *per se* invalidate the system. The fault lies more often in the dilatory methods of Russian engineers rather than in the mode of procedure.

When all the features of the proposed design have finally been decided on, the work is turned over to a group of designers, detailers and tracers. This group is about evenly divided between the sexes and is supervised by an engineer, who may also be supervising other groups as well. The group thereupon makes an elaborate contract with the "direction" of the bureau, detailing minutely of what the completed work is to consist, what compensation the group is to receive and what bonuses and penalties are to be applied for super-excellence or infringement of clauses. The members of the group assembled in meeting decide on the repartition of the contract price, each member being assigned a percentage of the whole corresponding to his or her recognized ability.

The engineer works on a straight salary basis but shares in a bonus earned in the proportion assigned to him by the group. Besides this, if the group excels in its work, the engineer will be awarded by the direction, with the approval of the particellule and trade union committee, a bonus equivalent in most instances to a month's salary. The salary of a Russian design-



Typical blueprint of hydraulic feed system for machine tools shows quality of Russian drafting room work

ing engineer runs from 500 to 800 rubles a month, which provides a standard of living approximately equal to that of a machinist in America.

I will say that the level of technical education of young graduates even from the mushrooming engineering schools of the U.S.S.R. is not inferior to that found in the U.S.A. All students who have come under my observation have shown a remarkable thirst for knowledge, resulting from their conviction that Russia has an historic mission in the world.

Research Going On Constantly

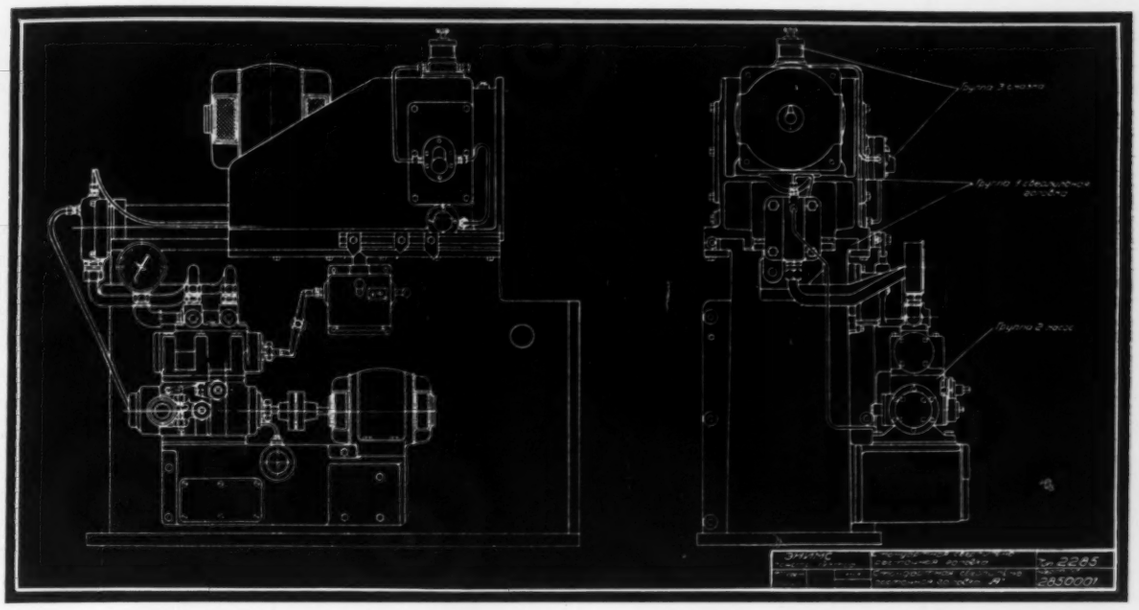
There is an immense amount of research and experimental work going on in the machine industry. Following are a few examples of successful projects taken at random from a notebook. The chemical laboratory in one large machine plant has developed a new varnish which is protective against rust and exposure to the elements, and which, it is claimed, spreads an invisible film so thin as not to interfere with the operation of the finest instruments.

Electric welding is receiving an enormous amount of attention. One plant makes milling cutters with a high-speed steel outer shell in three sections electrically welded to a carbon steel core. Approximately the same process is used by another plant for making tungsten tipped oil well drills. Still another plant makes knife blades by electrically welding a very thin sheet of alloy steel (chromium 2 per cent, tungsten 12 per cent) between two thin sheets of rustless steel.

Some years ago a small group of Russian emigres returned to the U.S.S.R. to organize the Re-Emigrant Factory. Today this originally small cartel has developed into a large factory known as the Moscowsky Instrumentalny Zavod. This organization is of national importance because it now produces the finest special tools, such as accurate Gleason bevel gear generator cutters, Fellows and Pfauter gear shaper cutters and grinders, broaches, hobbing tools of all shapes, etc.

Good Results from Experiments

These few instances of successful development could be extended almost *ad infinitum* and into all branches of industry. The cost of all this experimental work is of course great but it seems to be easily absorbed in the national economy and results eventually in surprising spurts of progress in all the arts of processing and manufacturing. I will cite two more instances in widely removed fields of industry: In the Dombas coal field we see coal burned underground in the vein and turned into power without being brought to the surface. In the textile industry I have seen looms for weaving cotton cloth running at 200 RPM. These are equipped for automatic replacement of the filling quill when it becomes



Centralized lubrication system is used on this hydraulically controlled machine tool

empty, thus enabling one operator to look after twenty looms.

If it can be said that there is a definite trend in Russian machine design, it is toward more fully automatic operation and higher production. In the machine tool field this does not, up to the present, mean a return to the expensive, highly specialized, single purpose machines of a few years ago. Rather, it denotes the assembly around fast handling fixtures of standard units having definitely limited functions, the fixtures being as nearly automatic in loading and clamping as it is possible to make them. There is a strong current towards standardization of functional units of machine construction. Instances are lathe heads, boring heads, milling heads, mechanical and hydraulic feed units, and infinitely variable speed units, ranges of sizes being selected to cover the major part of the field. The scope of these standardized functional units is bound to increase with expansion of the industry, which is scheduled to produce 40,000 machine tools this year as against 20,000 in 1935.

Inventions Are Numerous

The manufacture of producer's goods machinery does not lend itself very well to the employment of standardized functional units. In this field it may be said that almost no complication of design is too great if it results in increased quantity or quality of product. Naturally there is a good deal of thrashing about in wild cat forms of invention. Young Russian inventors are so earnest that they are not easily dissuaded from their plans. This I know, having spent many hours in such endeavors. They must be convinced point by point that their invention is impractical, otherwise they will appeal to the union committee, the party cellule and the press.

From this great ferment of inventiveness continually fostered and encouraged by the entire press of the country, there is bound to emerge occasionally a really brilliant idea which compensates for the large amount of work involved in checking all the proposals presented. For instance, here is a report published sometime ago in a bulletin, "Social Economic Planning in the Soviet Union" which states: "Out of 63,000 inventions and rationalization proposals made in one year in ten industrial enterprises, 46,000 were adopted, resulting in a total saving of 20 million roubles". No figures are given on the amount of the cash rewards, nor of checking and installing the chosen proposals but it is reasonable to assume that it may have equalled the saving effected. However, the psychological value of this mass stimulation towards thinking and planning cannot be estimated in rubles.

Directions issued by the Central Machine Designing Trust for the guidance of engineers, stress the desirability of certain features of design. Designers of machine tools of the cutting type are instructed to provide, whenever feasible, for adaptation of the machine to carbide cutting tools, this without too many steps of feed and speed changes. Sturdiness and safety of operation are principal qualities to be incorporated in all machines. Sturdiness means not only resistance to wear and vibration in main elements under maximum duty but also avoidance of delicate control mechanisms. Hand controls particularly must be able to withstand the roughest usage.

Safety of operation applies equally to operator and machine. Safety for the machine is obtained by the usual interlocking levers, switches, slip clutches and overload relays; also when feasible, by colored lights and sound warnings to call attention of any one in

the vicinity to improper operation of the machine. Safety of the operator must be insured by every means available, regardless of cost.

Designers are also instructed to spare no effort in devising foolproof, uninterrupted lubrication. Splash or flood lubrication from a pump circulation system is preferred. When this is not feasible, measured, piped lubrication from a central lubricator is demanded. Where pump-circulated lubrication is adopted, designers are instructed to provide for automatic shut-off of the main drive if the oil circulation or line pressure fails. German builders feature flood lubrication on many of their machines, nonshatter glass windows being provided at various points for observation of the flooded mechanism.

Demand for electric current in the U.S.S.R. is always considerably ahead of the supply. For this reason the capacity of drive motors is carefully balanced against the work capacity of the machine, whereas in the U.S.A. we often find drive motors 50 per cent in excess of normal machine requirements. Machine capacity is rated by the maximum volume in cubic centimeters of material removed per minute, along with maximum tool pressures. This is usually accompanied by elaborate performance graphs and charts. Many European machine builders also supply tabulated data pertaining to their machines.

The Russian designer is often handicapped by lack of information on available parts and materials. There is as yet no extensive trade literature cataloging an almost infinite variety of available products and ready-made parts, comparable to that of other countries, particularly the U.S.A. Since the excellence of a machine depends to some extent on quality and finish of its stock parts, Russian machines although they may show a high degree of inventive skill, cannot as yet compare with German and American machines in appearance and effectiveness. The Russian designer also is handicapped at every turn by lack of dependable information on quality and characteristics of available materials. This applies to raw as well as finished materials and compels the selection of higher factors of safety than are used in other countries.

Practically all ball and roller bearings used in the U.S.S.R. on Russian machines are manufactured at the mammoth Kaganovitch plant in Moscow. They correspond to international sizes and listings but in general their quality and performance still fall short of American bearings. For machine tools they are selected on the basis of 3000 to 5000 hours service under maximum load.

The Dynamo plant in Moscow is a large producer of electric motors but their product is far from embracing the wide variety of characteristics offered for the selection of the designer in the U.S.A.

Nomenclature of the available steels follows closely the SAE standard but with fewer listings in each group. Quite a number are listed under their OCT and SAE designations. Because of the scarcity of these metals, alloys containing nickel, copper or aluminum are reserved for the armament and automotive industries. The machine industry must be content with chromium and manganese steels except in special cases. Generally chromium is used for gears machined after heat treatment and manganese for casehardened gears.

Special emphasis is placed on technical studies in the young Russian's education. Marked attentiveness is being shown at a demonstration

Heat treating processes, apart from the type of equipment used, are now fairly uniform universally for given alloys and purposes. Heat treating furnaces are either oil or gas fired, electric current being too scarce for heating purposes. Babbitt metal follows closely SAE specifications 10 to 14.

In conclusion, I must say that machine design in the U.S.S.R. is gradually shaking off the impediments that have been hampering its progress. Its future is practically assured because of inherent freedom from economic or financial restrictions which tend to retard technical development in other countries.

Scanning THE FIELD FOR Ideas

HIGH speed, centerless feed light grinding, polishing and finishing is carried out in a unique manner by a system developed by the Production Machine Co., whose machine is designed also to be set up for handling tapers, irregular shapes and flat work. The basic idea of the system, which is patented, is shown diagrammatically in *Fig.* 1 in which the left-hand view shows the setup for cylindrical work with its secondary feed belt; while the right-hand view shows the setup for flat work with solid platen.

The "finishing tool" is an endless cloth abrasive belt 6 inches wide and 1 feet long. This abrasive belt in turn rests upon a cushion belt. The latter is of heavy leather and has a corrugated face of herringbone variety. These herringbone corrugations, coming as they do immediately beneath the abrasive belt, give it high points for cutting with low points immediately adjacent for chip clearance. The effect is comparable to the alternate teeth and clearance spaces of a broach.

In operation the cushion belt runs over pulleys at 6300 feet per minute, while the abrasive belt, which is looped over it, tends to operate at a slightly increased speed due to the enlargement of the driving pulley by the arc of thick leather cushion belt. This increase in speed which amounts to about 1½ inches to every revolution of the drive pulley is neutralized in operation when pressure is applied behind the two belts. The result is that travel of the abrasive belt is retarded slightly at its working point causing it to assume high and low sections which follow the corrugations of its supporting cushion belt. After passing the working point the abrasive belt straightens out—expelling the chips. This action is illustrated.

New Possibilities for Plastics

AS THE technique of fabrication of the newer materials develops, industrial designers are quick to take advantage of the possibilities which are thus opened up. A typical example is that given by the notable advances in the use of plastics, due to the ability of molders to turn out parts of constantly increasing size. A specific case in point is that of the Pilot Radio Corporation's new all-wave receiver.

The cabinet of one of the table models of this instrument is shown in *Fig.* 2 in the hands of the molder, who has just removed it from the press. This is said to be one of the largest housings as yet produced in Bakelite molded. The cabinet is 18¼ inches high, 13½ inches wide, 10⅜ inches deep and weighs ten pounds. It is produced by Associated Attleboro Manufacturers Inc., on a new 500-ton press which constitutes the background of the illustration, die and core being clearly visible.

The same advantages which manufacturers some time ago discovered in connection with the production of "midget" sets hold true in this large cabinet. It is produced in a single operation, no finishing other than the removal of thin fins is required and the attractive color is integral with the material—in other words, "it goes all the way through." The high mechanical and dielectric strength also is highly advan-

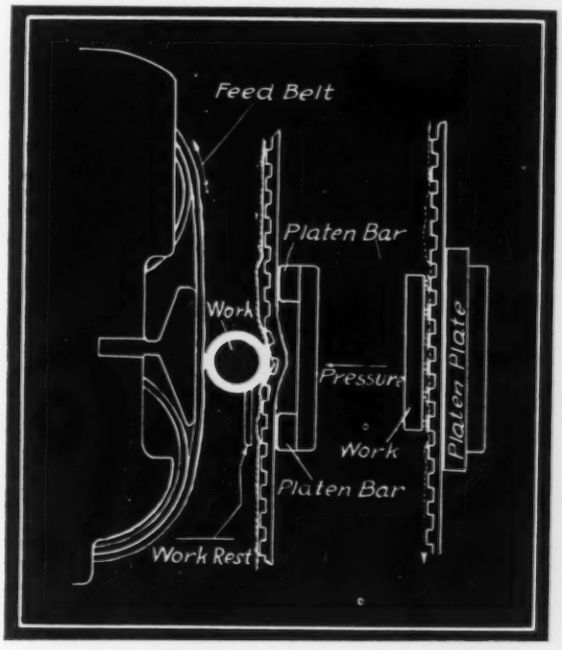


Fig. 1—Cushion belt with herringbone corrugations improves cutting action of abrasive band

tageous as is the durability of this molded material.

From the point of view of the designer, the possibilities for new ideas in styling presented by large molded plastic housings are very wide. That Jan Streng who designed the cabinet shown in the illustration took advantage of the new possibilities is plainly evident.

Mercury Switches Insure Safety

IN an automatic scale recently designed by the Richardson Scale Co. for use by the Cuban government in weighing imported gasoline and oil for customs purposes there are thirty-eight separate switches—all automatically actuated by scale beams, cams or floats. These switches, of which *Fig.* 3 shows examples of installation, are of mercury type, and are—together with the improved connectors—products of the General Electric Vapor Lamp Co., which co-operated on the design.

The scale, which will handle approximately 1,653,000 pounds of gasoline per hour, has two complete weighing tanks one of which fills while the other is emptying. This gives practically continuous operation. The two weighing beams on each tank are so arranged that lots of predetermined net weight—say of 12,000 pounds—are delivered during each operating cycle regardless of variations in viscosity, in rate of flow or of residue adhering to the tank. Accuracy of one-tenth of one per cent of true weight for any 100 discharges is guaranteed.

A series of mercury switches make and break contacts in proper sequence thereby controlling motor-driven camshafts which actuate the intake and discharge valves on each set of tanks. When 90 per cent of the load has entered the weighing tank the scale beam goes into action to cut down the valve opening from full flow to dribble. Then as the amount in the weighing tank comes up to its full load, another mercury switch is tilted by the action of the scale beam, thereby energizing a solenoid which in turn trips a trigger which completely closes the inlet.

Others of the mercury switches provide automatic stopping in case any batch being weighed exceeds the prescribed tolerance, while still others operate lights indicatitng filling, discharging or balancing.

Float switches insure at least a weigh tank of liquid in the feed tank before the intake valve opens. Ordinarily, control is such as to maintain synchronized flow between supply and take-away. However, another float operates a mercury switch to sound a siren if the discharge is threatening to fill the emergency overflow tank.

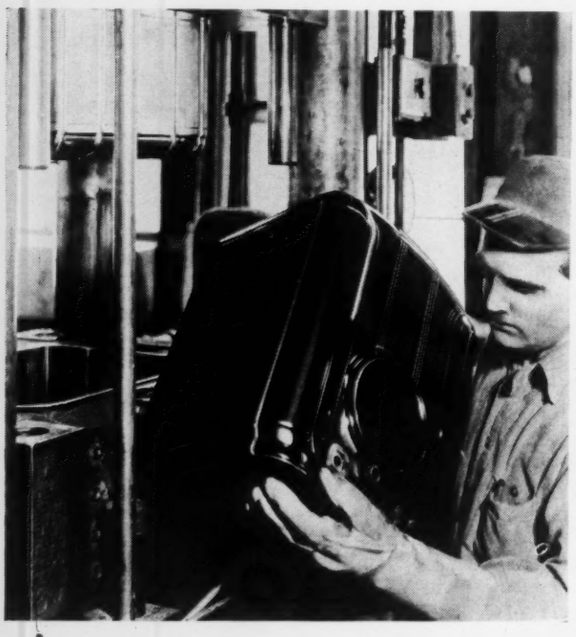


Fig. 2—Production of large cabinets in Bakelite molded plastic is forward step in radio development

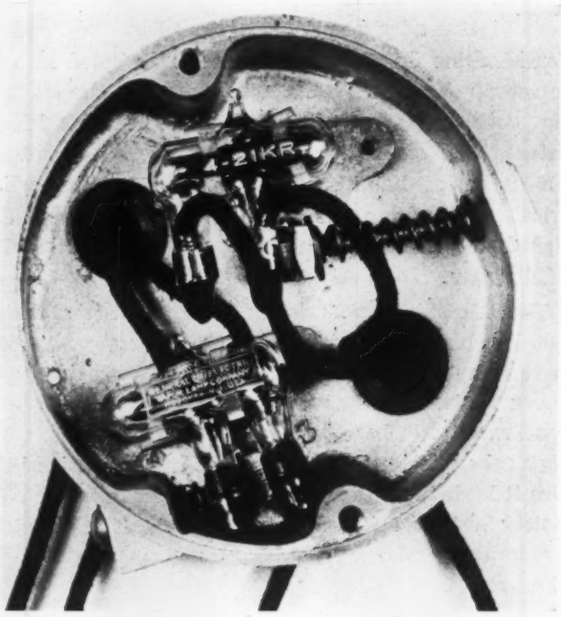


Fig. 3—Mercury switches actuate automatic gasoline scale, eliminating possibility of explosion

In an apparatus of this kind which handles gasoline, elimination of explosion hazard is vital. Despite the large number of control circuits in constant operation, use of mercury switches throughout permits a continual succession of make-and-break contacts with no possible danger of sparking.

Davy Principle Is Improved

WHEN Sir Humphry Davy invented the safety lamp for miners in 1815, he discovered and made use of a principle of physics which today has many industrial applications of which he little dreamed.

The principle is that if an inflammable gas is separated from a frame merely by a piece of heat-con-

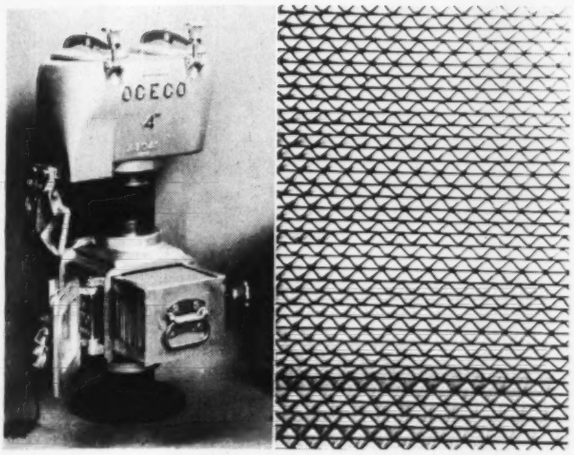


Fig. 4—Improved flame arrestor at left, with enlarged view looking through its "honeycomb" element

ducting wire gauze, the heat necessary for ignition will be dispersed by the gauze, will not penetrate to the gas and the gas will not burn.

In *Fig.* 4 is shown a modern flame arrestor patented by T. J. Calhoun and built by the Johnston & Jennings Co. for use on breather pipes of oil storage tanks. Here the Davy screen has developed into a thick "honeycomb" made up of plain and corrugated sheets of pure aluminum, whose high heat conductivity and corrosion-resistance makes it ideal for the purpose.

Scale Controls Flow of Material

MANUFACTURERS of gypsum products, cement, glass and chemical products often are faced with the problem of feeding into their grinding mills, mixers, slurry tanks, kilns, etc., accurate amounts of the materials which are to be combined. This is true particularly in the case of continuous processes in connection with which automatic equipment is employed.

To tie in this proportioning and feeding-in operation with other automatic operations, Merrick Scale Mfg. Co. has developed an apparatus called the Feedoweight, a typical adaptation of which is shown in *Fig.* 5. This automatic scale-feeder, designed as it is to weigh "materials on the move", is closely related to a conveyor system.

The Feedoweight apparatus can be used either singly or in combinations of two or more for proportioning mixtures. It has a mechanically controlled power regulator which opens or closes a control gate in the storage hopper.

Desired predetermined rate of feed is obtained by simple manual adjustment of a poise weight, the weighing being accomplished by suspending a short section of the conveyor from the scale levers. The poise weight is set on its beam to the desired tonnage by means of a knob. Thereupon the scale mechanically regulates the opening or closing of the hopper gate accordingly. Only the predetermined weight of material is allowed to pass over the conveyor, irrespective of variations in its unit size or weight.

The scale beam is always free to assume its true balance position. If the load on the conveyor section becomes even slightly too heavy or too light, the beam is thrown out of equilibrium, causing a sensitive pilot device instantly to "signal" this condition to the power regulator, which immediately goes into action to decrease or to increase the amount of opening of the hopper gate to correct the flow. Installation of the apparatus can be made either on an existing pan or belt conveyor system or—as in the case illustrated herewith—it can be furnished as a complete system embodying a short conveyor-feeder. Equipment includes an automatic continuous totalizer with dial which registers and indicates the weight of material passed through.

The belt shown has ruffles which eliminate necessity for skirt boards. They are 4 inches high, of rubberized fabric and are shaped to pass freely around head and tail pulleys.

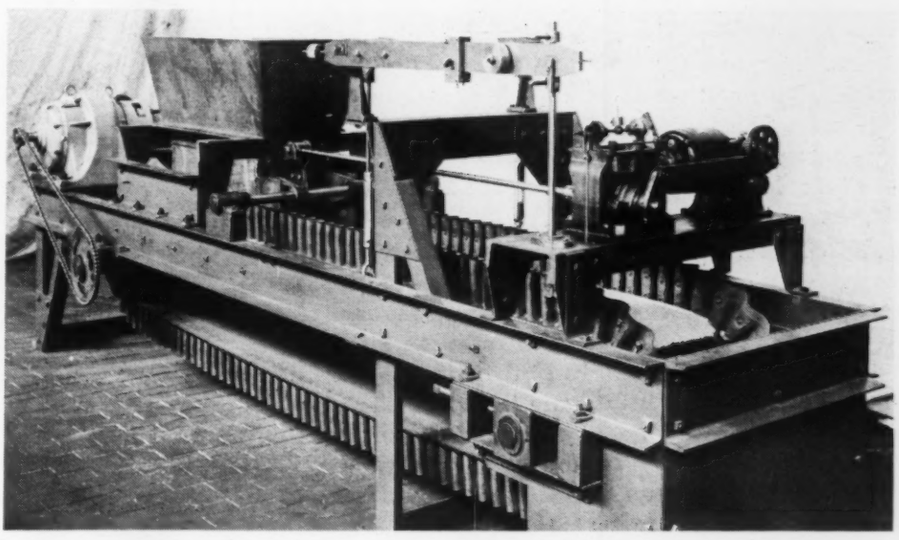


Fig. 5—Continuous weighing and recording device is mechanically connected to adjustable hopper gate through a sensitive "signalling" and control mechanism, thus insuring constantly accurate conveyor-feeding of process material as predetermined

An Engineer's W

He May

Fig. 1—A. W. Soderberg, chief engineer, Carnegie-Illinois Homestead works, re-enacts episode which inspired his rocking shear

THOMAS A. EDISON is said to have defined invention as "one-tenth inspiration and nine-tenths perspiration". This undoubtedly is true if all the thought and effort required to whip an invention into practical form is taken into account. There is nevertheless a persistent idea that many useful inventions have started spontaneously with a flash of inspiration, that some of them actually have sprung full-fledged from the brain of the inventor, without the slightest effort on his part.

While this question, "How do inventors invent?" is ever an intriguing one, the easy road to invention has yet to be found. It should be borne in mind that literally an engineer's work is never done. When an idea eventually does flash into his mind it is fully as apt to be at home—perhaps in the middle of the night—as it is to be at the office during official working hours. Nor does the idea come floating into an idle mind. Rather, it occurs as a result of long hours of the hardest kind of concentrated thinking which goes on—sometimes consciously, sometimes unconsciously—all day long and long after the quitting whistle has blown.

So obscure is the original source of many an inventor's basic idea that he may be wholly at a loss to identify it. This is not true, however, in the case of a unique and successful shear recently put into service at the Homestead works of the Carnegie-Illinois Steel Corp. So definitely aware is A. W. Soderberg, chief engineer of the works, of the circumstances under which this basic idea came to him that we see him in *Fig.* 1 re-enacting the scene exactly as it happened and in the place where it happened.

For years the steel industry had been annoyed and puzzled by the "bow" or "arch" that developed when a straight edge shear bit into a wide plate of steel. The industry was annoyed because this bow necessitated an additional leveling process. It was puzzled because no one had been able to develop a shear that would

Fig. 2—Home-made wooden model of shear proves its principle by cutting sticks of gum without bowing

r's Work Is Never Done—

ay nvent at Home!

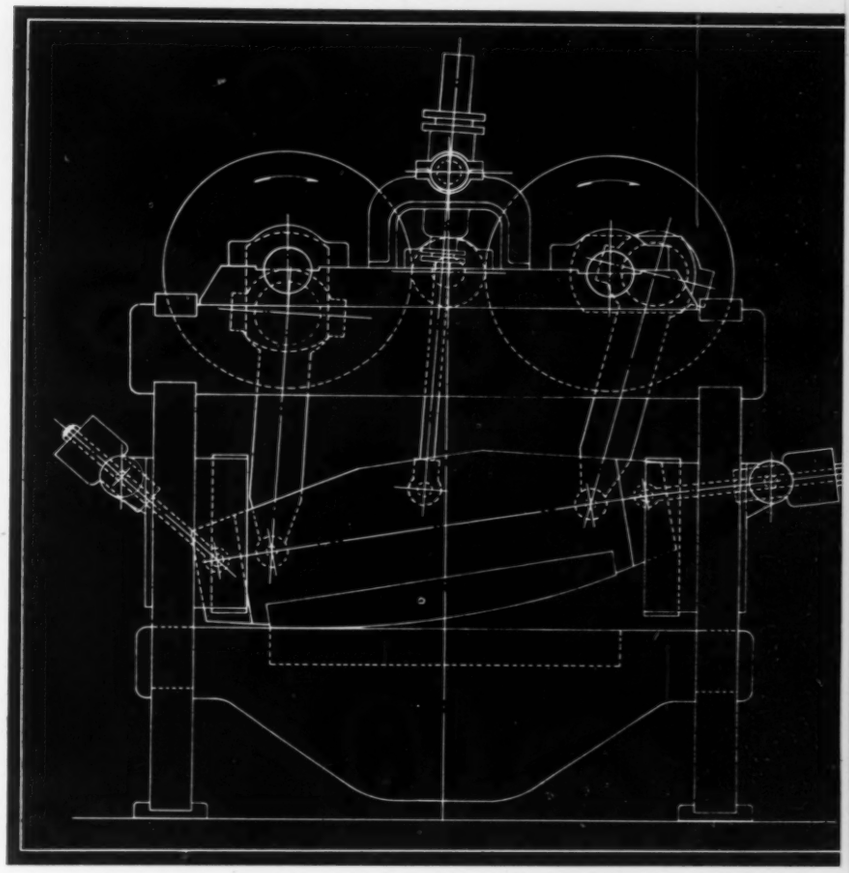


Fig. 3—Front elevation of the full-size rocking shear as it was developed "on the board" in the engineering department, for use in connection with a new 100-inch strip mill. It is worthy of note that this finished design follows very closely the original conception as visualized through Mr. Soderberg's small wooden model

eliminate this very annoying difficulty.

And so it came about that Mr. Soderberg was mulling over this problem late one night in his study at home. In the midst of his contemplations, he happened to tip a rocking chair with his foot. The teetering chair caught his eye, he watched the action of the moving rockers on the rug and noticed that only a very small portion of a rocker actually touched the rug at any given time. Immediately there flashed into his mind the thought: "Perhaps I can develop something out of that!"

Working in his shop at home after hours, he built a small wooden operating model of such a shear as was suggested to him by the action of the rocker. Convinced that it had possibilities, he took it to the works to show to his associates. With the help of the model he explained to them that the important point is that no knife travel occurs after the bottom of the top knife passes the top of the bottom knife. To demonstrate this point he sent out for a supply of chewing gum which he snipped off, a stick at a time, between the wooden blades of the model, as is shown in *Fig.* 2. The gum, representing steel plates, was cut without bowing effect.

After this effective demonstration, Mr. Soderberg's idea was taken up with enthusiasm by the Carnegie-Illinois management and it was turned over to the engineering department in connection with the development of a 100-inch strip mill then well under way.

It may seem like a big jump from the tiny home-made model to the massive 80-ton shear which took form "on the board" in the engineering department. Actually, however, the jump was in size rather than in principle. This becomes obvious through careful study of *Fig.* 3, which is a reproduction of the assembly drawing of the front elevation of the big machine as it emerged from the engineering department. It does almost seem that here may be an invention which did spring full-fledged from the brain of the inventor—that is, it does until we recall the long hours of thought and work put into it by Mr. Soderberg both before and after the vital flash came to him.

The linkage, through which the peculiar rocking motion of the upper blade of the shear is attained, is depicted clearly by *Figs.* 2 and 3.

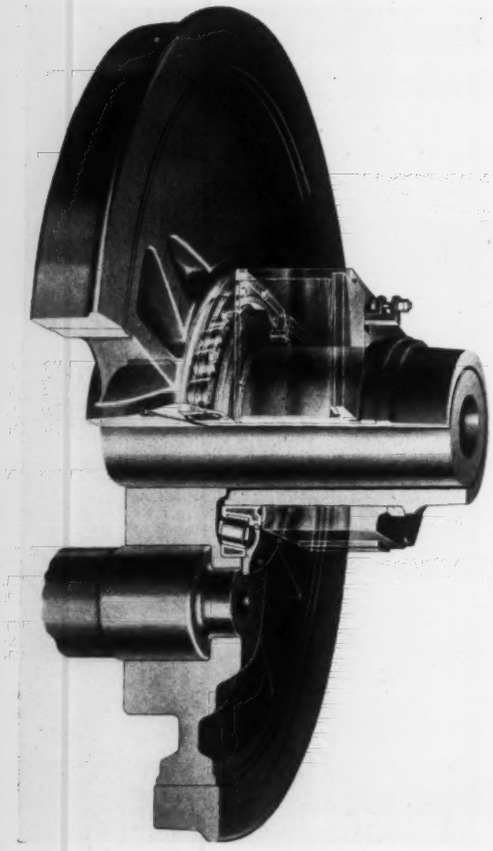


Fig. 1 — Roller bearing mounting on "floating axle" of locomotive driving wheel

Diverse Uses Show U

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WITH practically every type of machine in existence or under development—processing, metalworking, domestic, business, transportation, to mention a few—utilizing antifriction bearings in their construction, the scope for advancement in bearing design is almost unlimited. Bearing makers have not been slow to recognize this and have capably met the requirements of machine designers. There are few bearing problems that have remained stumbling blocks for long—sooner or later one or more of the bearing producers have found solutions satisfactory to all concerned, and have capitalized on the knowledge gained by applying it to still other problems.

Some of the more recent, diversified applications discussed in the following show clearly the attitude of the machine designer in employing the newer types of bearings and mountings. *Fig.* 1 illustrates a roller bearing locomotive driving wheel of the so-called "floating axle" type in which a tubular member or axle sleeve has a roller bearing mounted at each end.

Axle Tubes Take Locomotive Weight

The outer races of the bearings are recessed into the driving wheel hubs and the axles thus carry none of the weight of the locomotive. As can be seen the axle tube is supported in the driving boxes at the sides of which the bearings are mounted. This novel installation, made on a Norfolk & Western locomotive, is claimed to be the first of its kind.

Not only have antifriction bearings during the past several years been applied successfully to extremely high load application, they also are being utilized more and more where close tolerances and precision are factors. An example can be found in the application to the belt-driven centrifugal pump shaft shown in *Fig.* 2. One of the important requisites in centrifugal pump design is the accurate maintenance of clearance between the rotor and the pump casing. Reverse thrust loads also come into action at intervals.

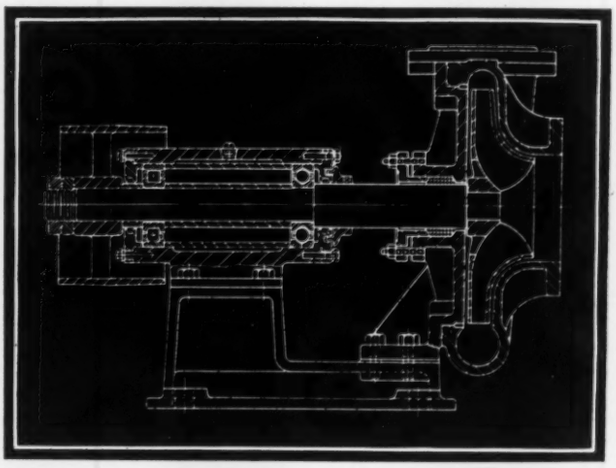
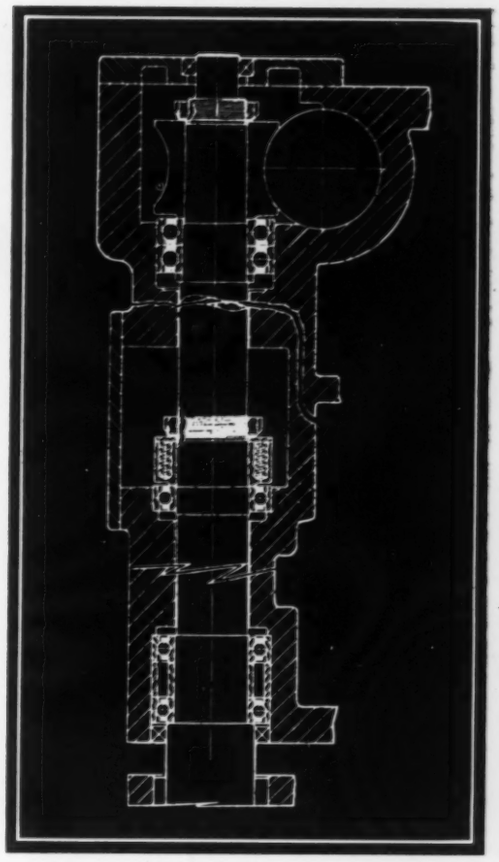


Fig. 2—Pump shaft mounted in ball and roller bearing—the latter with two-piece outer ring

Such conditions are adequately taken care of by a duplex angular contact type bearing, as used at the pump end of the bearing mounting illustrated. This bearing has a two-piece outer ring and specially ground raceways which provide high thrust capacity in either direction, while reducing end play to a minimum.

An entirely different installation is indicated in *Fig.*

Fig. 4—Rigidity and precision are obtained by using three sets of bearings



w Universal Applications

d Roller Bearings

3, this covering a dredge pump equipped with self-aligning bearings. The self-aligning feature is especially desirable on this type of service as particular accuracy is not called for in machining and assembling the bearing mountings. Inasmuch as the type of bearing used has concave rollers and an inner race with a spherical surface, the bearing is able to adjust itself to compensate for shaft or housing misalignment. This may be present at the outset or may develop due to the severe service a dredge pump is called upon to withstand.

Unlimited accuracy in limited space is frequently a

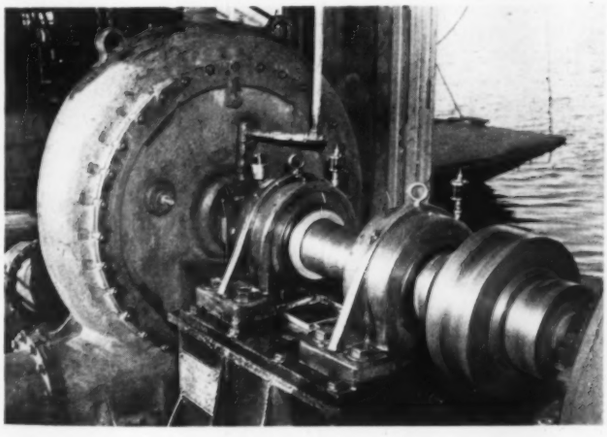


Fig. 3—Self-aligning bearings are utilized on shaft of dredge pump to facilitate smooth operation

requisite in design of machine tools. As examples, the close quarters created by the short center distances between shafts of multiple-spindle drilling machines or automatic screw machines, *Figs.* 4 and 6 respectively, could well be cited. In most cases of this nature, large bore bearings with small diameter outer races are used to obtain compactness.

The shaft (one of six) of the multiple-spindle drill shown in *Fig.* 4 has three bearing units, the bottom application involving a pair of deep-groove bearings separated by a spacer. This unit works in conjunction with the center unit above it, the latter being equipped with springs to apply the desirable loading to the lower pair to insure maintenance of radial and axial rigidity of the spindle. Adjustment is obtainable through the nut and sleeve directly above the springs. The upper pair of bearings also is slightly preloaded to eliminate any possibility of radial looseness or vibration at this point.

Permits Axial Movement

To take care of shaft expansion and contraction due to heat or some other factor the unique bearing mounting shown in *Fig.* 5 has been developed. The bearing housing rests on three movable segmental supports, thus permitting the housing to move axially within certain limits. Constant center height of the shaft is maintained by means of the radius at the bottom of the segments.

By this simple construction the necessity for sliding the bearing in the housing is eliminated, and expansion or contraction of the shaft is provided for with negligible friction. Load rating of the supporting seg-

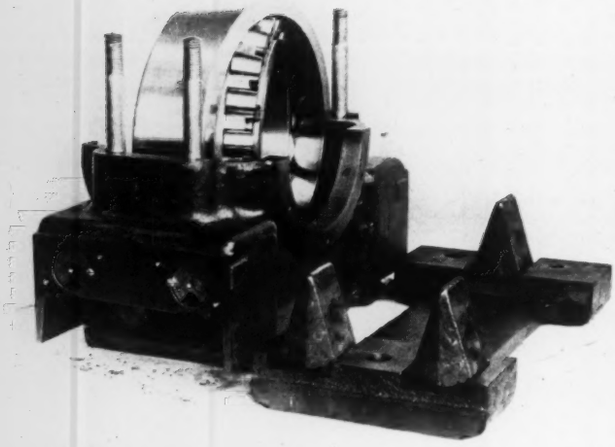


Fig. 5—Rocker wedge mounting incorporates three moving supports on which housing may move axially within limits while maintaining correct center height

ments has been figured, incidentally, at fifteen times that of the maximum bearing loads.

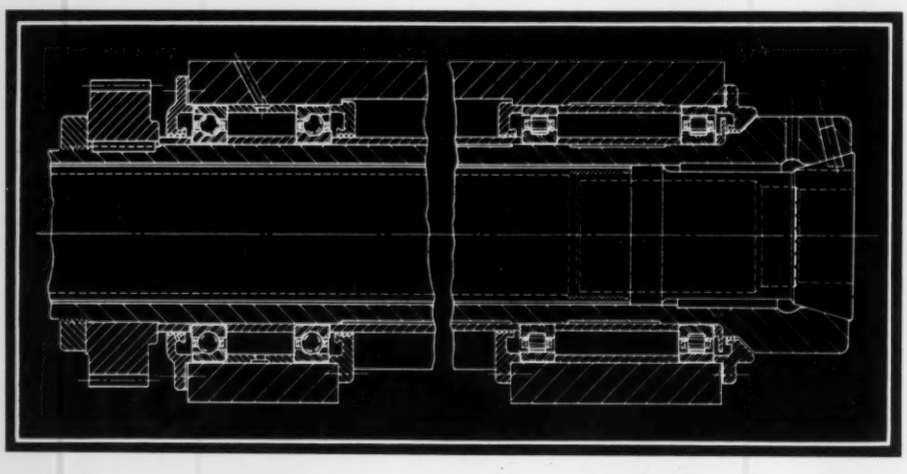
Fig. 6, the other drawing featuring a machine tool installation, shows the bearings and the mounting for one of the spindles of an automatic. As mentioned, compactness is essential in this type of application, this being taken care of by the use of "extra light" ball and roller bearings with large bore and relatively small outside diameter. At the work end of the spindle two specially selected roller bearings are used, both inner and outer rings being clamped endwise.

The thrust load of the spindle, as well as the radial load at the drive end, is carried on two angular contact bearings which are subjected to slight preloading by means of accurately ground spacers between the rings. The outer spacing washer is slightly longer than the inner by an amount sufficient to provide the desirable preload.

Unusual on account of the severity of service is the application of bearings to a concrete vibrator as illustrated in *Fig.* 7. Practically the entire part of the vibrator shown in the drawing is thrust into wet concrete to increase its density and strength. Vibratory action is created by out-of-balance of the rotor, thus throwing additional load on the bearings. Furthermore, the air motor driving the device runs up to speeds of 10,000 RPM.

To meet the severe conditions, double bearings of the sealed type are used both to retain lubricant and to add increased protection against the entrance of foreign matter. Satisfactory service has thus been assured.

MACHINE DESIGN wishes to acknowledge the courteous assistance of the following companies in the preparation of this article: Bantam Bearings Co., Fafnir Bearing Co., New Departure Div. of General Motors Corp., Nice Ball Bearing Co., Norma-Hoffman Bearings Corp., Rollway Bearing Co. Inc., SKF Industries Inc., Shafer Bearings Corp., and Timken Roller Bearing Co.



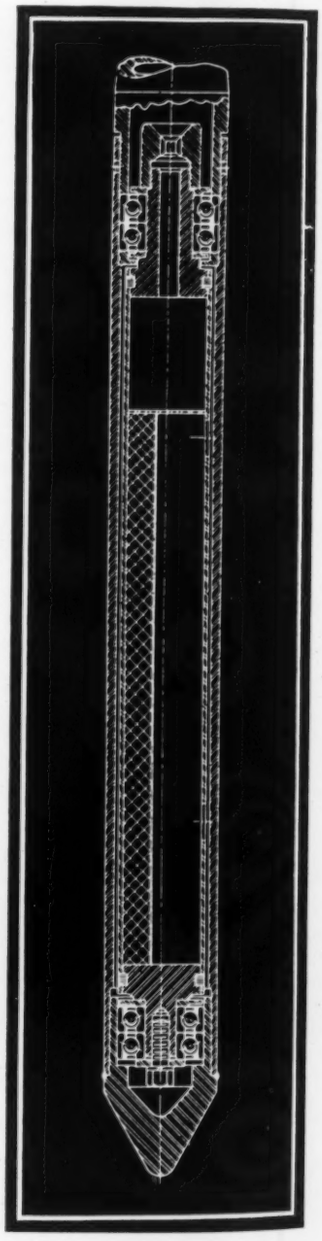


Fig. 6 — Below — Extra light bearings having large bore but small outside diameter are found to be ideal where center to center dimensions are limited, as in automatic screw machines. Fig. 7—Right—Intended out-of-balance of rotor, as well as severe operating conditions inherent in concrete vibrator service, are met by sealed-in type double bearings

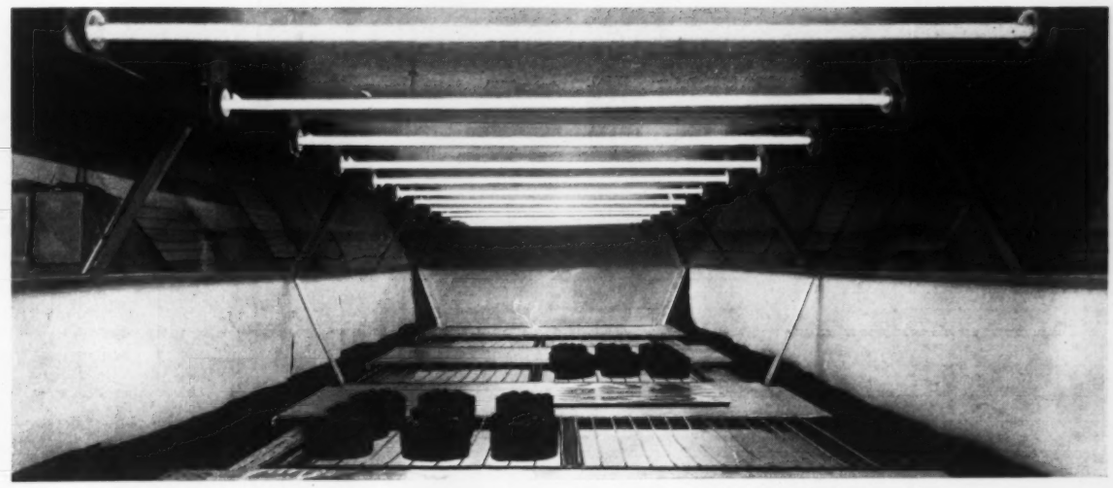


Fig. 1—Interior of irradiation cabinet for "sterilization" of fruit cakes

Sterilizing by Machinery

SANITARY processing and handling of food products by machinery represents one of the most important contributions of the mechanical engineering profession to public welfare and undoubtedly has done much to keep down the cost of living in this age of industry.

New possibilities in the performance of food machinery have now been opened up by the Sterilamp, a development of the Westinghouse Lamp Co. This is a low-wattage gas-filled electrical conductor in the form of a slender glass tube, which—when a current is passed through—produces radiations outside the spectrum of visible light. These radiations have a swift sterilizing action on the mold spores in the air which are the primary cause of food spoilage.

In the baking industry especially these new lamps have already been put into successful practical use. *Fig.* 1 shows an application of the germicidal lamps at the Columbus, O., plant of the Kroger Grocery & Baking Co. for the retardation of mold growth on fruit cakes. As many as 250,000 cakes per month have been "sterilized" in this apparatus, with noteworthy results. Before the system was installed spoilage of the cakes averaged about fifteen per cent. Exposure to the germicidal radiation has cut this figure down to one or two per cent.

Continental Baking Co., Hoboken, N. J., has applied a battery of the germicidal lamps to an automatic cake wrapping machine in the manner depicted by *Fig.* 2. In this instance exposure to the rays has been found to lengthen the mold-free life of the product anywhere from one and one-half to two days, even under conditions of high temperature and high humidity, which are major factors contributing to mold growth. Adaptation of the process to bread slicing and in connection with air-conditioning of the bakery is contemplated.

Factors favorable to wide commercial application of the Sterilamps are their low initial cost and their low operating cost. On alternating current installations the only auxiliary equipment required is a transformer—three or four lamps being operated from one transformer. Power required for two of the lamps, plus that consumed by the transformer, is less than that required for an ordinary 25-watt bulb.

Fig. 2—Method of applying a battery of Sterilamps on in-feed conveyor of a wrapping machine

Stress Analysis Is by New M

By K. E. Bisshopp

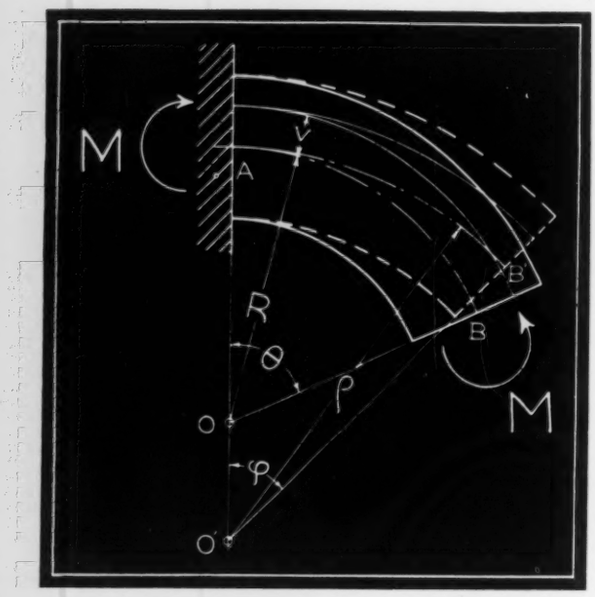


Fig. 1—Beam calculations are based on theory transverse sections remain normal to central line

ACCEPTED methods used for evaluating stresses in curved beams have certain disadvantages which can be avoided by a rearrangement of the analysis. Difficulties arise in attempting to evaluate that property of the beam cross section which takes the place of the moment of inertia. The resulting expressions become involved and bear little resemblance to the familiar straight beam formulas. One method depends upon the graphical determination of a "modified area" which gives stress formulas expressed in terms of the difference between the modified area and the actual area. This method requires taking the difference of two numbers and may give numerical results subject to inaccuracy.

The following analysis avoids these disadvantages and at the same time closely parallels the more familiar theory applicable to straight beams. Analogous stress relations are obtained by introducing modification factors depending on the natural curvature of the beam.

Extension of this analogy yields compact, symmetrical expressions facilitating the investigation of statically indeterminate problems in curved beams, rings and similar structures.

Derivation of Fundamental Stress Formulas

The ordinary theory is based on the assumption that plane transverse sections normal to the central line remain so after strain. Consider a short length of the beam *AB, Fig.* 1, which originally subtends an angle θ from its center O, and after strain subtends an angle ϕ from its new center O'. The unstrained length of a layer of fibers distant v from the central axis is

$$(R+v)\theta$$

and the new length is

$$(\rho+v')\phi$$

where v' is the value of v after strain. (For complete list of symbols see page 86).

The circumferential strain of this layer of fibers is

$$e = 1 - \frac{(\rho+v')\phi}{(R+v)\theta} \quad \ldots\ldots(1)$$

The central line has final length

$$\rho\phi = R\theta(1-e_o) \quad \ldots\ldots(2)$$

where e_o is the circumferential strain of the central line, $v = o$, which may be written

$$\phi/\theta = R/\rho\,(1-e_o)$$

Equation (1) reduces to

$$e = 1 - \frac{\rho+v'}{R+v} \times \frac{R}{\rho}(1-e_o) =$$

$$1 - \frac{1+\frac{v'}{\rho}}{1+\frac{v}{R}}(1-e_o) \quad \ldots\ldots(3)$$

Disregarding the difference between v and v' introduces negligible error. Equation (3) then becomes approximately

$$e = \frac{v(1-e_o)\left(\frac{1}{R}-\frac{1}{\rho}\right)}{1+\frac{v}{R}} + e_o \quad \ldots\ldots(4)$$

Assuming no lateral pressure between the longitudinal fibers the unit stress at a distance v from the central line is

$$S = Ee \quad \ldots\ldots(5)$$

$$\Sigma\,(S\delta a) = O = E\,\Sigma(e\delta a) \quad \ldots\ldots(6)$$

where δa is the element of area and $\Sigma\delta a = A =$ total cross sectional area of the beam. Substituting the value of e from (4) in (6) and dividing by E

Is Simplified

Method

$$R(1-e_a)\left(\frac{1}{R}-\frac{1}{\rho}\right)\sum\frac{v\,\delta a}{R+v}+e_aA=O \quad \ldots.(7)$$

$$M=\Sigma\,(Sv\,\delta a)=$$

$$E\left[e_a\,\Sigma\,v\,\delta a+(1-e_a)\left(\frac{1}{R}-\frac{1}{\rho}\right)\sum\frac{v^2\,\delta a}{1+\frac{v}{R}}\right]$$

Since v is measured from the central line $\Sigma\,v\,\delta a=O$

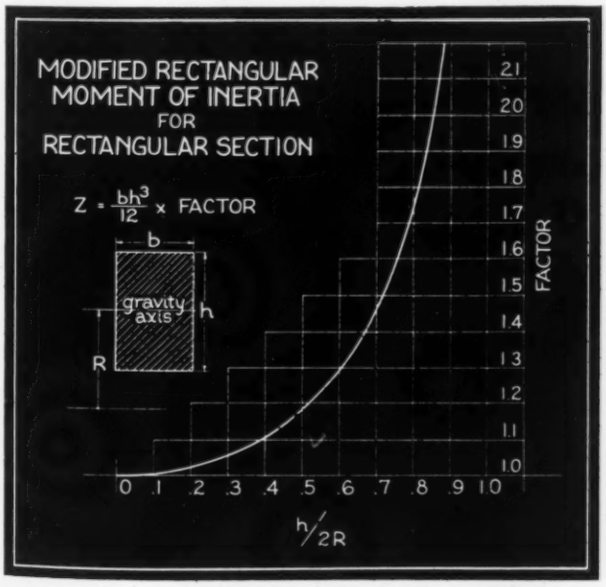
$$M=ER(1-e_a)\left(\frac{1}{R}-\frac{1}{\rho}\right)\sum\frac{v^2\,\delta a}{R+v} \quad \ldots.(8)$$

$$\sum\frac{v^2\,\delta a}{R+v}=\sum\left(v-\frac{Rv}{R+v}\right)\delta a=$$

$$-R\sum\frac{v\,\delta a}{R+v}$$

It is convenient to set

Fig. 2—Values for modified moment of inertia may be obtained from chart as well as analytically by formula



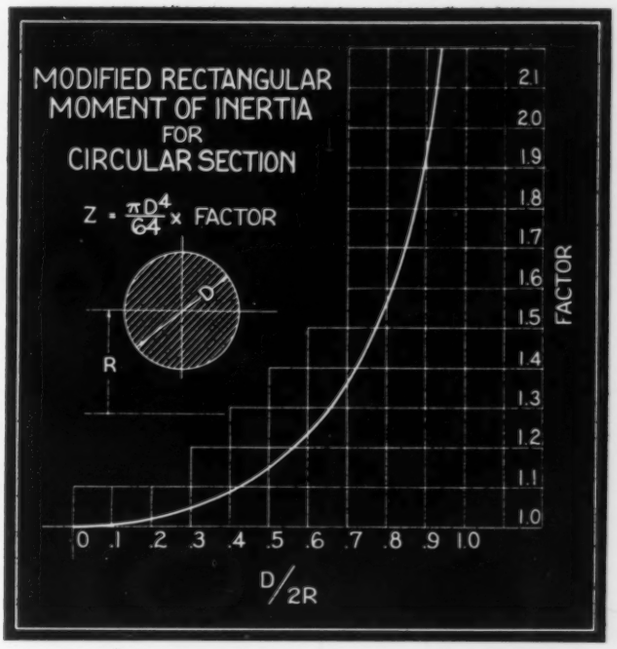


Fig. 3—Modified moment of inertia is product of moment of inertia and a modification factor from chart

$$R\sum\frac{v^2\,\delta a}{R+v}=Z \quad \ldots.(9)$$

On passing to the limit

$$Z=R\int\frac{v^2\,da}{R+v} \text{ and}$$

$$-R^2\sum\frac{v\,\delta a}{R+v}=R\sum\frac{v^2\,\delta a}{R+v}=Z \quad \ldots.(10)$$

The factor Z is called a modified moment of inertia. The corresponding moment of inertia I gives sufficiently accurate results whenever R is greater than eight times the depth of the beam. Equations (7) and (8) with (10) give

$$e_a=\frac{M}{EAR} \text{ and } 1-e_a=\frac{EAR-M}{EAR} \quad \ldots.(11)$$

$$\frac{1}{R}-\frac{1}{\rho}=\frac{M}{EZ}\times\frac{EAR}{EAR-M}$$

$$=\frac{ARM}{Z(EAR-M)} \quad \ldots.(12)$$

Substituting equation (12) in (4) gives

$$e=\frac{Mv}{EZ}\times\frac{R}{R+v}+\frac{M}{EAR} \quad \ldots.(13)$$

The stress for positive values of v is compressive, therefore

$$S=-Ee=-\frac{Mv}{Z}\times\frac{R}{R+v}-\frac{M}{AR} \quad \ldots.(14)$$

If an additional uniform normal force N acts on the section the unit tensile stress is

$$S=N/A$$

which combined with the bending stress gives

$$S = \frac{N - \frac{M}{R}}{A} - \frac{Mv}{Z} \times \frac{R}{R + v} \quad \ldots\ldots\ldots (15)$$

By setting $N - M/R = \eta$ this result reduces to

$$S = \frac{\eta}{A} - \frac{Mv}{Z} \times \frac{R}{R + v} \quad \ldots\ldots\ldots\ldots (16)$$

which is the general formula for stress in a curved beam. If v_1 and v_2 are the values of v at the extreme inner and outer fibers respectively, then the maximum tensile stress in the beam section is

$$S_1 = \frac{\eta}{A} + \frac{Mv_1}{Z} \times \frac{R}{R - v_1} \quad \ldots\ldots\ldots\ldots (17)$$

and the maximum compressive stress is

$$S_2 = \frac{\eta}{A} - \frac{Mv_2}{Z} \times \frac{R}{R + v_2}\,^{*} \quad \ldots\ldots\ldots\ldots (18)$$

Location of the Neutral Axis

The position of the neutral surface is determined by setting $S = O$ in equation (14) which gives

$$v = -\frac{RZ}{Z + AR^2} = -\gamma \quad \ldots\ldots\ldots\ldots\ldots\ldots (19)$$

The negative sign shows that the neutral surface is inside of the central line. (Note: The symbol γ is used frequently in the literature for the distance between the neutral surface and the central axis.)

Comparison with Straight Beam Formulas

The form of the stress equations shows that a straight beam may be considered as a curved beam with an infinite radius of curvature; thus as R approaches infinity Z approaches I, equation (9), and equation (16) then reduces to

$$S = \frac{N}{A} - \frac{Mv}{I} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (20)$$

which is the formula for stress in a straight beam at a distance v from the central axis caused by a bending moment M and tension N. In either case positive bending moment produces tension in those fibers inside or below the neutral surface.

Analytical Determination of Z

The mathematical expression for Z is obtained by evaluating the definite integral equivalent of equation (9). For rectangular and circular cross sections Z may be written as the product of I and a modification factor depending on R and the depth of the section as shown in *Figs.* 2 and 3. An additional variable, the ratio of the upper and the lower bases, is required to express this factor for trapezoidal sections as shown in *Fig.* 4. The formulas for Z for rectangular, circular and trapezoidal sections are:

$$\textit{Rectangle: } Z = bR^2 \left\{ R \log_e \frac{R + h/2}{R - h/2} - h \right\}^{***} \quad \ldots (21)$$

$$\textit{Circle: } Z = R^2\pi\,(2R^2 - R(4R^2 - D^2)^{1/2} - D^2/4) \quad \ldots (22)$$

$$\textit{Trapezoid: } Z = R^4 \frac{b - a}{h} \log_e \frac{R + h_2}{R - h_1} + R^3 \left\{ \frac{bh_2 + ah_1}{h} \log_e \frac{R + h_2}{R - h_1} - (b - a) \right\} - AR^2 \quad \ldots (23)$$

The curves shown in *Figs.* 2, 3 and 4 were constructed

*The analysis used in this section with slight modification may be found in Morely's *Strength of Materials*, 7th Edition, 1928, pages 390 etseq.

***Grashof's formula.

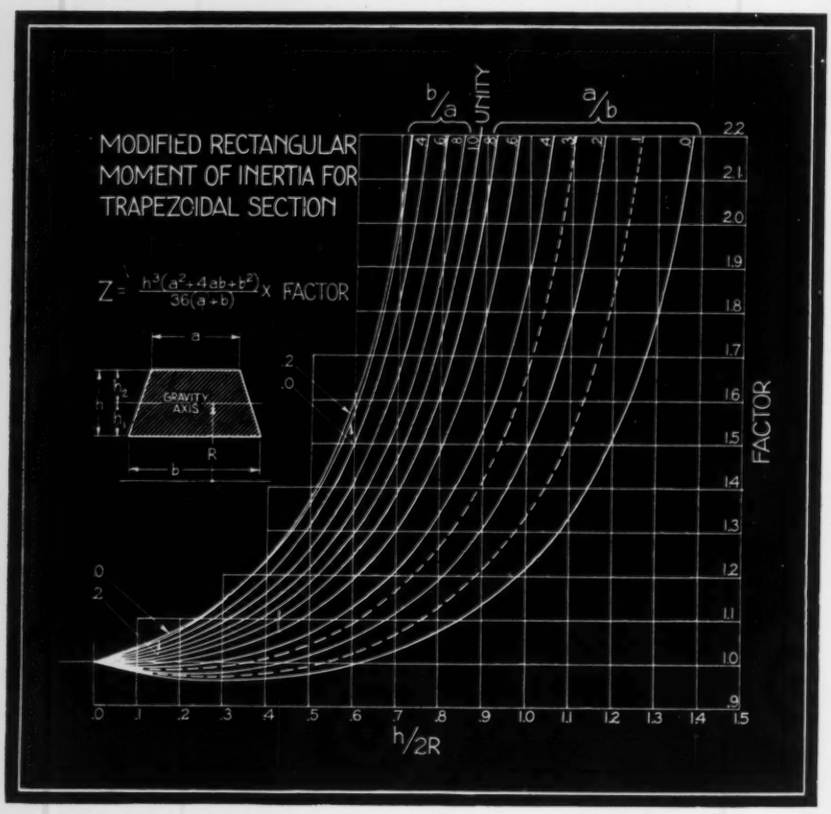


Fig. 4 — Modification factor for trapezoid involves two independent variables: a/b and h/2R

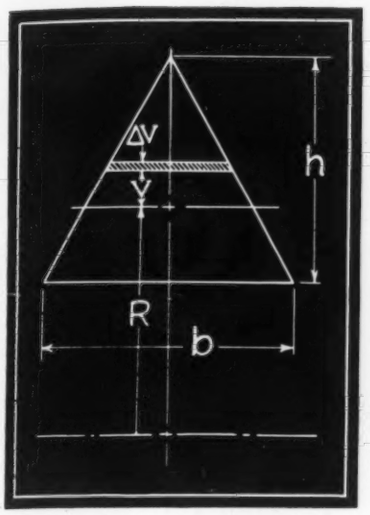


Fig. 5—Numerical evaluation of modified moment of inertia may be used where graphical and analytical methods are not practical

from these formulas with the aid of seven place logarithmic tables.

Numerical Evaluation of Z

Numerical methods of calculation may be used to advantage in many cases where graphical or analytical methods are impractical. The increasing prevalence of calculating machines now makes such methods even more attractive. As a numerical example, the factor Z for a triangular cross section will be evaluated directly from its definition (equation 9). Complete calculations are given below (see *Fig.* 5). Values are: h=12 inches; b=8 inches; δv=1 inch; R=8 inches; and $\delta a = 16/3(1-v/8)\delta v$.

(1)	(2)	(3)	(4)	(5)	(6)		
	$1-v/8$	$R+v$	v^2	$\frac{v^2(1-v/8)}{R+v}$	Simpsons' Multipliers	Product for Area (2)x(6)	Product for Z (5)x(6)
−4	1.500	4	16	6.000	1	1.500	6.000
−3	1.375	5	9	2.475	4	5.500	9.900
−2	1.250	6	4	1.000	2	2.500	2.000
−1	1.125	7	1	.161	4	4.500	.644
0	1.000	8	0	.000	2	2.000	.000
1	.875	9	1	.097	4	3.500	.389
2	.750	10	4	.300	2	1.500	.600
3	.625	11	9	.511	4	2.500	2.044
4	.500	12	16	.667	2	1.000	1.333
5	.375	13	25	.721	4	1.500	2.884
6	.250	14	36	.643	2	.500	1.286
7	.125	15	49	.408	4	.500	1.632
8	.000	16	64	.000	1	.000	.000
						27.000	28.712

Area = 16/3 × 1/3 × 27.0 = 48 in.² (check).
$Z = 8 \times 16/3 \times 1/3 \times 28.712 = 408.3$ in.⁴.
$I = 8 \times (12)^3/36 = 384$ in.⁴.
$h/2R = 12/16 = .75$.
$Z/I = 1.063$.

The value of Z/I obtained by the foregoing numerical method agrees with the factor corresponding to $h/2R=.75$ on the curve for $a/b=O$ in *Fig.* 4. A simple geometric figure was selected in this case solely for illustrative purposes. The same procedure would be followed for a more complicated section, the only difference being that more computations might be required to determine the numerical values for the variable width of the section, where in the example a simple analytic expression for this quantity (16/3 x column 2) is obvious.

**This example is taken from Timoshenko and Lessells' *Applied Elasticity*, page 225.
‡Timoshenko and Lessells', page 228.

Application of Formulas and Curves

The classical crane hook problem which occupies a prominent place in books on strength of materials provides an illustration of the practical application of this method. **Referring to *Fig.* 6, $a=.375$ inch, $b=1.625$ inches, $h=3.75$ inches, $R=2.734$ inches, $A=3.75$ sq. in. and $P=4500$ pounds.

$$I = \frac{(3.75)^3 \times [(.375)^2 + 4 \times .375 \times 1.625 + (1.625)^2]}{36 \times (.375 + 1.625)} = 3.822 \text{ in.}^4$$

$a/b=.231$, $h/2R=.686$, Factor=1.115 (see *Fig.* 4), M=4500 x 2.734=12,300 inch pounds, $\eta=0$

Equation (17)

$$S_1 = \frac{12{,}300 \times 2.734}{3.822 \times 1.115} \times \frac{1.484}{1.25} = 9365 \text{ pounds / in.}^2 \text{ Tension}$$

Equation (18)

$$S_2 = \frac{12{,}300 \times 2.734}{3.822 \times 1.115} \times \frac{2.266}{5} = 3576 \text{ pounds / in.}^2 \text{ Compression}$$

Further Consequences of the Theory

Not only does this analysis furnish compact formulas analagous to the familiar ones encountered in straight beam theory, but it also forms a basis for the treatment of statically indeterminate problems in curved bars and rings by the use of strain-energy methods. The expression for the energy of deformation stored in a curved beam is, neglecting shear‡

$$dU = \left(\frac{M^2}{2RA\gamma E} + \frac{N^2}{2AE} - \frac{MN}{AER}\right) ds \quad \ldots\ldots (24)$$

per unit arc length. This expression reduces to the simpler and more symmetrical form‡‡

$$dU = \frac{1}{2}\left(\frac{M^2}{EZ} + \frac{\eta^2}{EA}\right) ds \quad \ldots\ldots\ldots\ldots\ldots (25)$$

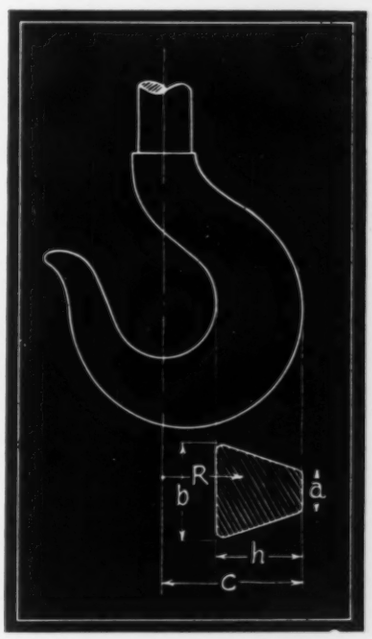


Fig. 6 — Ordinary crane hook gives good example of the application of beam formulas

‡‡Muller-Breslau *Die neueren Methoden der Festigkeitslehre*, U. S. A., 4 Aufl. S. 236.

(*Continued on Page* 86)

Shoe Machinery Involves

By B. P. Cooper

SHOEMAKING is an ancient craft, but it is little more than a century since machinery was first used for the purpose. In 1810, when the need arose for large quantities of boots for the troops engaged in the Napoleonic wars, the elder Brunel invented the first riveting machines which attached the uppers to the soles by driven and clenched nails. Some 400 different machines now are used in the industry. The largest weigh over two tons, and the smallest machines only a few pounds. Some are very complicated in construction, and one particular machine contains as many as 3000 parts.

Unusual mechanical problems are encountered in shoe machinery which are seldom met in other types of mechanisms. Precise and delicate sewing operations require unique drives and linkages and it is with the thought these unique mechanisms may be applied to other machines that description of the parts is given.

On many machines it is necessary to have a single-revolution clutch which will cause the machine to stop within an accuracy of a few degrees of a revolution, and yet at the same time be capable of causing the machine, to run continuously while a pedal is depressed. This has been met by the "swash ring" type of clutch, and many examples of this may be seen in shoe machinery.

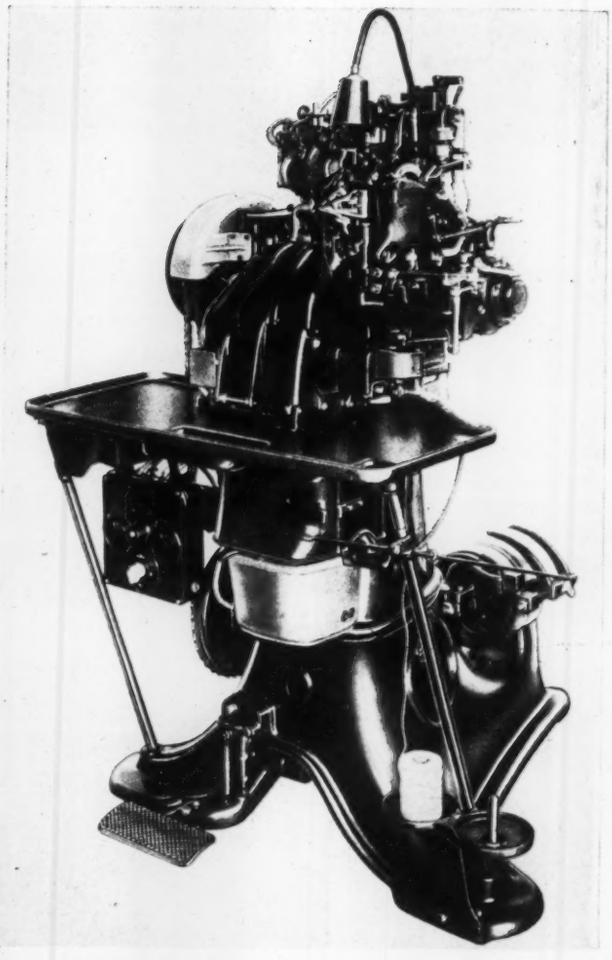


Fig. 1—Outsole lockstitch machine sews at high speed with better quality than hand stitching

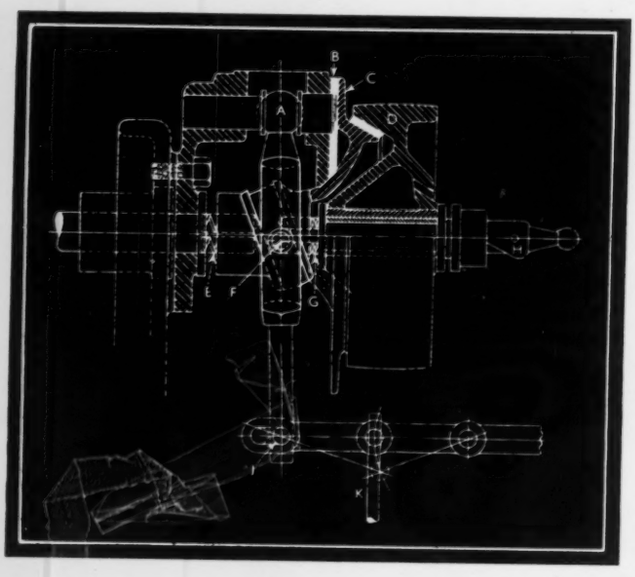


Fig. 2—"Swash ring" type of clutch allows machine to make one revolution and stop at predetermined point

The action of this clutch has been described thus: "hold the dog and it wags its tail, hold the tail and you wag the dog." An example of the mechanism is

This article abstracts the design sections of a paper presented recently at the British Institution of Mechanical Engineers where it attracted much favorable comment. The author, a member of the Institution, is manager of the British United Shoe Machinery Co., Ltd., Leicester, England.

Many Intricate Mechanisms

illustrated in *Fig.* 2 where the member *C* may be considered as the dog, and the remote end of *A* as the tail. The cone clutch member *C* is splined to the mainshaft of the machine, and when free from the restraint of the withdrawing means *A*, *F*, and *K* is caused to engage the driving member of the clutch by the pressure of the springs *E*. The cone member is provided with a circumferential groove which is in an oblique plane in relation to the axis of the shaft.

Clutch Has Unusual Operation

The member *A* embraces the cone and carries on pivot *F* an annular link which runs in the groove of the clutch. It should be noted particularly that the center of the pivot is not on the center line of the axis of the shaft, but is a small distance below. Since this is the case, a line taken through the point *F* will participate in two movements: One a movement of oscillation about a center running vertically through the shaft caused by the obliquity of the groove, and another movement longitudinally to the shaft axis and caused by the position of the point *F* below the center. The member *A* is shown pivoted at its upper end in ball seatings, and oscillates about this point. The longitudinal movement given to *A* at *F* is increased at the lower end where it is connected to a toggle *J K*. As long as the member *A* is permitted to oscillate, it does not do any useful work upon the cone clutch *C*, but if the movement of the tail end of link *A* is arrested by toggles, the action of the cam surface will cause the cone clutch to be forced away from the driving pulley and into engagement with the brake face *B*.

In order that the machine may be turned over by hand, the release knob *H* is provided to allow the driving pulley to be withdrawn so far that upon the release of the link *A*, resultant upon breaking the toggle, the clutch cannot slide far enough to engage it and thereby be positively driven. The movement of the cone to its normal driving position has, however, allowed the brake to be released, freeing the machine for hand operation.

The universal pattern grading machine employs simple geometric principles and operates with accuracy to produce the necessary patterns smaller and larger than the original. *Fig.* 3 shows in diagrammatic form the mechanism of the machine.

The model pattern is clamped to a grid. In its normal working position this is turned on its hinge on the jack and lies in a horizontal plane. *Fig.* 3 shows the material (board or metal) to be operated upon by the punch, clamped in a lower plane than the model pattern. The model is pressed against the guide pin *B* and the punch, which acts in the manner of a nibbling machine tool, moves to the right or left of *B* under the influence of the settings given to the pantograph by the scales at *B* and *G*. As shown by the dotted outline, the machine is set to produce a pattern of larger size than the model, but if the fulcrum *C* is moved to its mean position, *A* will move to *E* on the center line *ECF*, and *D* will move to the right and bring the guide *B* coincident with the punch in the same vertical line but in a higher horizontal plane. Having made the desired settings, the operator starts the high-speed reciprocating punch and moves the jack,

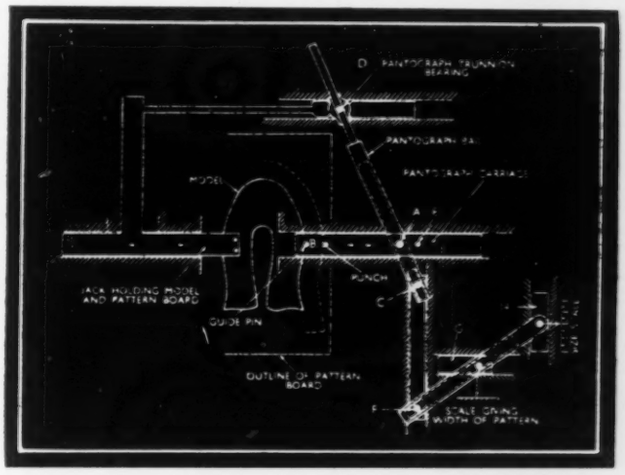


Fig. 3—Pantograph mechanism enables operator to make model shoe pattern smaller or larger than original

which carries the model in such a manner as to feed it around and in contact with the guide *B*. From the patterns thus made dies or knives of the same outline are produced for cutting the shoe components.

The problem of selecting, separating, and feeding such loose articles as tacks, nails, and eyelets has required considerable study and one particular example will be described in some detail. *Fig.* 4 shows in diagrammatic form the essentials of the mechanism for

separating and delivering tacks, point upward, for use in the pulling-over machine. The machine actually deals with seven tacks, but for sake of clarity one only is shown. It will be observed in this case that the tack, after separation from the raceway, falls by gravity through its conducting tube into a semicircular junction near the driver bar; it is here that the tack turns upside down so as to finish with its point upward.

Machine Drives Tacks

To raise the tack from the semicircular junction, a piston is latched at one end of a cylinder against a compression spring; on the release of this latch the piston is forced upward by the spring, causing a puff of air to blow the tack from the junction into a position immediately above the driver. Prior to this operation a valve, shown below the separator, closes the passage behind the tack, so that the air can only flow in a direction to carry the tack forward. In the path of the driver a pair of pivoted fingers are held together by a light spring; these guide the point of the tack as it is being driven into the shoe. They also act as a stop against which the tack can strike when it is blown forward, after which it falls backward with its head upon the end of the driver. Only one piston and cylinder are required, as the latter is connected to each of the seven tack passages. It should be mentioned here that in most cases of tack and nail feeding, the final position, prior to driving, is with the point down, as this is the natural position when suspended by the head.

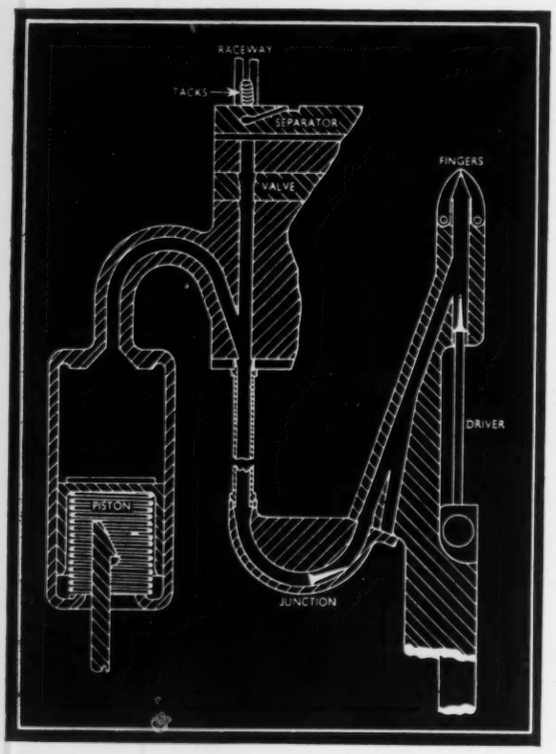


Fig. 4—Puff of air from piston blows tack through tube to position in front of driver

Another problem that confronts the designer of shoe machinery in a raceway is to keep the thread employed in the chain stitch, used to unite the welt to the shoe, under a tension of varying degree during the formation of each stitch. While the needle is drawing the loop the tension must be light, and during the time the stitch is being drawn tight, by means of the "take up," the tension must be heavy.

The mechanism shown in *Fig.* 5 illustrates a means of accomplishing this. The thread is drawn from a wax pot and passes around a tension wheel *H* to which a brake drum is rigidly connected on the same axis. The tension on the thread is produced by a brake in the form of two brake shoes which are arranged to bear on the periphery of the drum. The brake shoes *G* and *J* are mounted on an arm *F*, which in turn is mounted on the outer end of a lever *E*. Downward

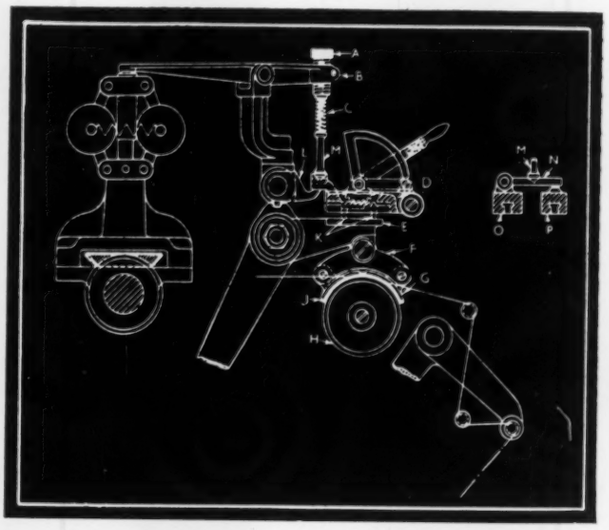


Fig. 5—Tension of thread is automatically varied from heavy to light by this mechanism as stitch is drawn

pressure is applied to the top of lever *E* and causes the brake to retard the rotation of the tension wheel *H*, thus exerting tension on the thread. The desired tension is applied through the spring *C* and the connections shown between it and the lever *B*. The spring exerts pressure on the rod *M*, between a shoulder and the end of the adjusting screw *A*, mounted on the lever *B*. The end of the rod presses on the center of a pivoted bridge piece *N*, which is employed as the means of exerting pressure on the two levers *O* and *P*, or on only one of them.

At that portion of the cycle of operation when full tension is required, the pressure is exerted on both levers *O* and *P*, and these in turn act on the lever *E* to apply the maximum tension; whereas at that portion of the cycle when the light tension is required, the pressure is removed from lever *P* by means of the arm *L*, which is actuated to lift the free end of the

bridge piece and sustain the pressure which would otherwise act on the lever *P*. It will be seen that in this state the pressure will be shared by the lever *O* and the arm *L*.

It is desirable to be able to adjust the amount of light or heavy tension independently of each other. To do this the point of application of the pressure from the levers *O* and *P* to the lever *E* is applied by longitudinally adjustable abutments *K*, which may be set by the operator by means of the rack and segment of a pinion mounted in the levers *O* and *P*. When the machine is stopped and the work is withdrawn, it is desirable that the thread be relieved of all tension, and to secure this result the lever *E* carrying the brake shoes is lifted.

High Speed with Lockstitch Machine

The governor acts to modify the tension of the thread in relation to the speed of the machine: As the speed increases the tension is reduced. The tension device performs mechanically what the shoemaker does by his sense of touch, but with the added and important advantage that it does not fatigue and thereby lose its sense of correct tension, as may be the case when the pull is applied by hand.

The outsole lockstitch machine, *Fig.* 1, is an example of what has been accomplished by way of speed and quality of the product of the operation. This machine sews, as already mentioned, at the rate of 1000 RPM. *Fig.* 6 shows the mechanisms which control the thread, and the shuttle in the act of engaging the thread, which is held out as a loop by the aid of the thread lifter. Initial pressure on a treadle allows the pressure foot to fall. The presser is locked to resist the awl, which pierces the work while moving upward in its circular path. The presser is now slightly lifted and moves with the table from left to right on the "return feed." The presser again squeezes the work and is locked. The awl then moves out and the needle follows down the hole made by the awl.

Stitch Made Mechanically

Thread is laid in the needle hook by the looper. Just prior to this operation the thread hook deflects the thread lying between the table and the looper so that there is just sufficient thread to pull up to the under side of the work, while the needle rises to its top or retracted position subsequently.

The needle rises to take a loop of thread with it, and when the needle hook emerges from the top side of the work, it enters the needle guide slightly, trapping the thread in the hook. As the needle and guide approach the top, the thread lifter prepares a loop for the shuttle (*Fig.* 6 inset). The beak of the shuttle takes this leg of thread and carries it over the highest point of the shuttle. The lifter now returns and the needle moves forward, releasing the thread from its

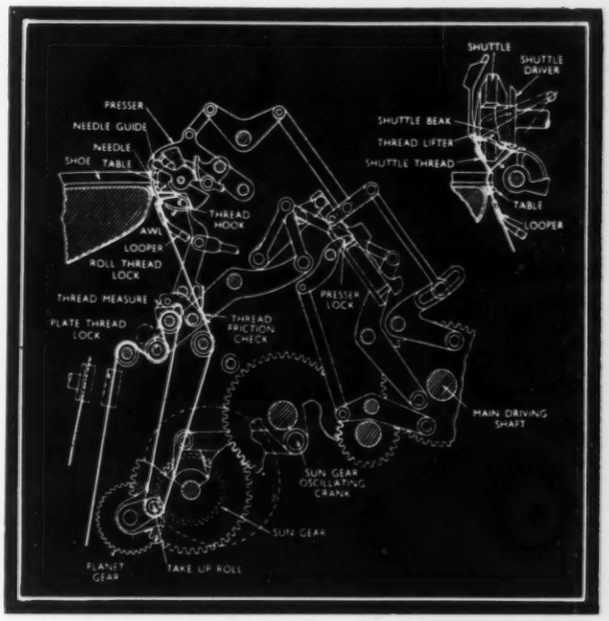


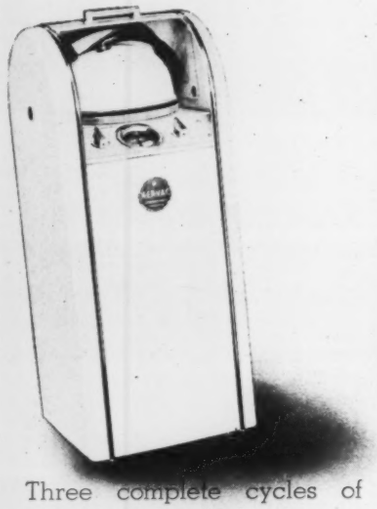
Fig. 6—Thread control for the sewing operation in the lockstitch machine is obtained in the manner illustrated

hook so that the shuttle is free from obstruction and is ready to make the locking loop as it rotates. The take-up rolls now operate to pull the locked loops to a predetermined depth below the surface of the work. This completes the cycle. All this takes place at almost unthinkable speed. The thread reaches a speed of a mile a minute.

A great deal has been written and said on the effect of labor-saving machinery upon unemployment. The shoe machinery engineer has no apology to offer for the mechanization of shoemaking, for by his efforts shoes have been made a relatively cheap commodity and at the same time a durable and pleasing article of wearing apparel. Mechanization also has proved a strong influence in the direction of better working conditions.

Castings Improved by Cement Molds

MORE intricate steel castings with exceptional smoothness, homogeneity and cleanliness are possible now with the utilization of sand molds incorporating cement as a binder. Little machining is necessary on the as-cast part and unusually difficult sections or water jackets may be cast, as the cement mold has much greater strength and ability to hold its shape. The use of cement as a binder in foundry molding is not new, as it has been used to a limited extent for 40 years. Only recently, however, has there been a real interest in the method. Reports from European countries give excellent results obtained with molds using a cement binder. Because of this molding improvement designers may specify castings which were not utilized to the best advantage a few years ago.



Three complete cycles of operation, in which pressure and vacuum are alternately applied to the scalp to stimulate hair growth are possible with the Xervac therapeutic machine, above. Motor and compressor are housed in the porcelain-finished cabinet

Appearance and operating efficiency have been improved in the Stearns magnetic separator, above, by enclosing all operating units and adopting roller chain transmission and antifriction bearings. Welded construction simplifies fabrication

Molded plastic
attractive finish
mechanism of t
card shuffler, abo
ly revolving cam,
of which is cover
escaping from tin
releases cards
points in deck
them to drop i

Controls and adjustme
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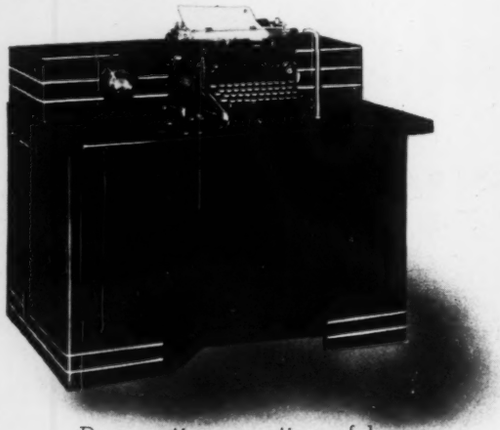
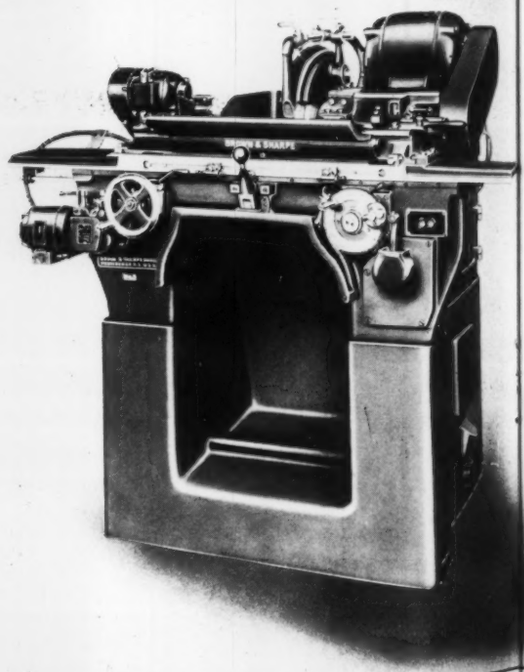


Pneumatic operation of keys in the Auto-typist, above, reduces wear and noise of machine. Device automatically types specially prepared letters or paragraphs which are selected by operator turning dial on machine. It may be used as ordinary typewriter



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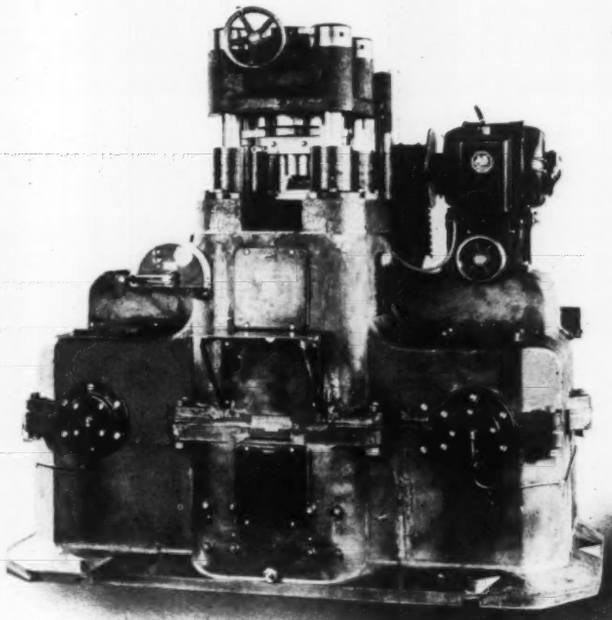
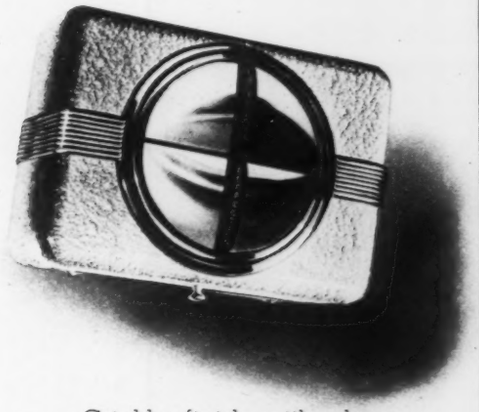
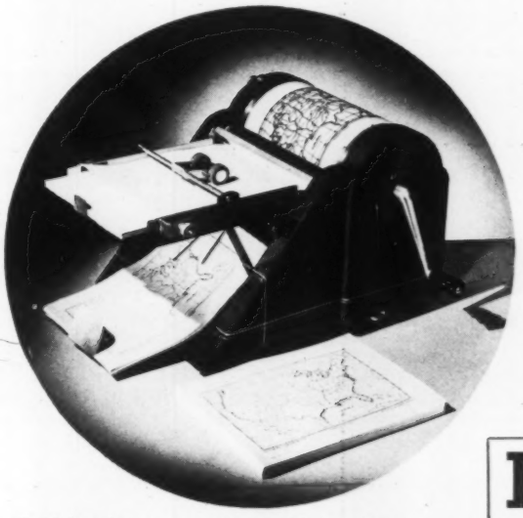


Pressure feed oil lines to all bearings insure trouble-free performance in the Colton dual-compression pre-forming press, left. Pressure which is applied to both sides of tablet overcoming die friction is taken by toggle links instead of press frame



Crinkle finish with chrome trim adds distinction to the two-purpose Eaton auto heater, above. Take-off for windshield defroster is built into unit and by turning butterfly valve hot air may be diverted to driver's feet



Self-feeding and self-ejecting, making for high-speed operation, the Ditto duplicating machine, above, reproduces as many as eight different colors at one time. Oil-sealed bearings prevent oil leakage and crinkle finish adds to appearance of machine

Design Features in New Machines

A Pictorial Presentation of Recent Machinery from the Standpoint of Design

Designed by [illegible]	Date Aug. 1937
Checked by [illegible]	File No. 13723
Approved [illegible]	Drawing No. 33507

New Machines Indicate Design Trends

PLASTICS have gone a long way in displacing metals and other materials in machine design. Possessing characteristics that make them easy to mold or form, having a finish readily brought to a high gloss, and being light and corrosive-proof it is only natural that engineers have adopted them for a multitude of parts. Indications are that plastics will be used even more extensively, especially in the automotive industry, in 1938. H. M. Northrup, chief engineer of the Hudson Motor Car Co., points out that plastics can be made rugged and capable of withstanding heavy stresses and wear, as in the case of laminated timing gears, as well as highly decorative. Radiator ornaments are now made of a resinous material and it is likely that dashboards, panels and similar parts will soon be of a similar substance. Preliminary developments on clear compounds show the possibility of a flexible plastic product which can be formed into thin sheets to replace glass.

Air Conditioning

All-year-air unit, Central Mfg. Div., Auburn Automobile Co., Connersville, Ind.
Air circulators, Cook Electric Co., Chicago.
Domestic and commercial stoker, Conco-Sampsel Stoker Corp., Mendota, Ill.
Air circulators, General Electric Co., Schenectady, N. Y.

Bakery

Automatic dustless flour weighing hopper, Read Machinery Co., New York.

Concrete

Truck mixer and agitator, Ransome Concrete Machinery Co., Dunellen, N. J.
Electro-magnet feeder, Allis-Chalmers Mfg. Co., Milwaukee.

Confectionery

Beverage cooler, General Electric Co., Schenectady, N. Y.

Dairy

Roto-matic bottler, Creamery Package Mfg. Co., Chicago.

Domestic

Streamlined mixer, Landers, Frary & Clark, New Britain, Conn.
Oil-burning furnace, Lochinvar Corp., Chicago.
Electric dry shaver, Miracle Dry Shaver Corp., Chicago.

Electrical Equipment

Watercooled AC and DC generating plants, D. W. Onan & Sons, Minneapolis.

Excavating

Excavator, Harnischfeger Corp., Milwaukee.
Convertible Shovel, Koehring Co., Milwaukee.

Finishing

Automatic coating unit, Paasche Airbrush Co., Chicago.

Food

Noodle making machine, Aurelio Tanzi Mfg. Co., New York.
Flour and powder sifting and rebolting machine, B. F. Gump Co., Chicago.

Foundry

Automatic sand blast, Leiman Bros., New York.
Electric recirculating dryers, Electric Airheater Co., Mishawaka, Ind.
Cantilever jar squeezer, Tabor Mfg. Co., Philadelphia.

Industrial

Electrically heated compound pot, Harold E. Trent Co., Philadelphia.

Laboratory

Electric furnace, Lindberg Engineering Co., Chicago.

Materials Handling

Hydraulic lift truck, Lyon Iron Works, Greene, N. Y.
25-yard trucks, White Motor Co., Cleveland.

Metalworking

Metal drying machine, Metalwash Machinery Co., Inc., New York.
Surface grinder, Covel Mfg. Co., Benton Harbor, Mich.
Tool grinder, Russel, Holbrook & Henderson Inc., New York.
Dual control wire straightener and cutter, F. B. Shuster Co., New Haven, Conn.
Grinder, Kling Bros. Engineering Works, Chicago.

Restaurant

Baking oven for sandwiches, Oven-Kwik Corp., Chicago.
Bun slitting machine, Battle Creek Bread Wrapping Machine Co., Battle Creek, Mich.

Rubber

Flocking machine, John Waldron Corp., New Brunswick, N. J.
Three-rod rubber cutter, Farrell-Birmingham Co., Inc., Ansonia, Conn.
Tire grooving machine, Kwick-Cut Mfg. Co.,
Roller coater, Colloid Equipment Co., New York.

Textile

Spindletape lacer, Clipper Belt Lacer Co., Grand Rapids, Mich.
Machine for measuring and weighing picker laps, Saco-Lowell Shops, Boston.
Reed brushing machine, Greensboro Loom Reed Co., Greensboro, N. C.

Technological Boards Might Well Utilize The Services of Engineers

IF THE recommendations of the President's National Resources committee are accepted we shortly may see established—in addition to an overall Federal planning committee—a number of science subcommittees which will have as their specific purpose "investigating and reporting at regular periods the progress and trends of science and invention, and the possible social and economic effects flowing therefrom."

It is evident from a reading of the recently-issued report that the basic idea of the resources board is not to try to regulate applied science or invention but rather to set forth the implications that may follow technological progress. Examples of the development of six industries in which rapid progress has been made and by which the life of the nation has been affected are given as: Telephone, automobile, airplane, motion picture, rayon and radio.

Whether or not the work of such committees could be put to good use is a moot question. The widest possible vision on the part of the investigators would be needed to forecast many years in advance the effects of scientific and engineering achievement. Only if the services of men of acute vision can be obtained would the results be beneficial.

Engineers of the highest caliber—regardless of party affiliation—undoubtedly would willingly accept the responsibility of participating in a program of this nature. With their knowledge of industry and technology they are admirably equipped, and it would be only logical to look to the profession that is primarily responsible for technological change to foresee—if it can be done—the resulting effects.

It is hoped that established engineering societies will recognize this and will take steps to urge the appointment of members of the profession on any long-range investigating or planning committees that may be set up. Such influence might well be brought to bear through the American Engineering council or other representative body. The advice of the engineer has not been sufficiently sought in the past but here may be an opportunity to capitalize on the soundness of thinking, the industrial viewpoint and the scientific approach of the country's leading engineering executives.

Helping Them Think!

INSERTED between pages 82 and 85 of this issue is a two-page article toward which the attention of readers is directed. It obviously was not written specifically for MACHINE DESIGN, but because the thoughts expressed apply equally to any group of men engaged in industry, the opportunity to publish the article in this journal could not be allowed to pass.

Mr. Heller's assertions are convincing, to say the least. He hits the nail on the head when he claims that one or two men cannot do the thinking for an entire organization, and continues to hammer it home by forceful arguments and suggestions as he proceeds.

The contribution is well worth the reading time of any design executive—busy though he may be. There are many ways of making men think, but few that can be so readily and simply put into effect as those suggested in this article.

Professional Viewpoints

MACHINE DESIGN WELCOMES LETTERS SUITABLE FOR PUBLICATION

Moto-Scoot Incites Queries

To the Editor:

WE HAVE just noticed in the July issue of MACHINE DESIGN the photograph in the center spread feature of the novel Moto-Scoot. We are quite interested in this machine, but have been unable to obtain any information about it in Louisville. Will you please give us the name of the manufacturer so that we may get in touch with him without delay. If practical, this machine can be used very nicely in our business for delivery service.

—E. B. HOKE
Louisville, Ky.

EDITOR'S NOTE—Inasmuch as we have received a number of inquiries concerning the Moto-Scoot we take this opportunity to inform our readers that it is made by the Moto-Scoot Mfg. Co., 215 S. Western avenue, Chicago.

"Status Quo" Letter Draws Comment

To the Editor:

I HAVE read with interest both your leading June editorial and A. W. Forbes' comments on it in your July issue.

Mr. Forbes disagrees sharply with your statement that development of new industries helps bring prosperity. In fact, he believes that new industries actually retard prosperity by diverting demand from old to new products and services, thus killing the market of the old.

When new industries are born old ones often—but not necessarily—die. The motor car killed the carriage business; the incandescent lamp ruined gas fixture sales; the radio put a serious crimp in the phonograph market.

But these new industries employ thousands more workers, spend millions more for materials, salaries and research, and have stimulated many allied fields into increased productivity. Rubber and petroleum would still be puny industries without the automobile. Highway construction with its many allied fields would likewise be in a primitive state if it were not for the automotive industry. When a new industry is born its ramifications are almost limitless.

It's still a harsh world to live in, and if new goods and services catch the public fancy to the exclusion of the old that's too bad for the oldsters. But it would be a much worse world if progress was held in check because, in forging ahead, certain out-moded industries would suffer. Of course, new industries do not mean the death knell of the old if these out-of-date ones will adapt themselves. Other forms of transportation had U. S. railways on the ropes until rail executives awoke from their reveries of contentment and conservatism. By lowering fares, modernizing their equipment, and cutting schedules they are now making a real bid for public favor.

When old methods or practices die the result, as we have pointed out, is generally more jobs, not fewer; higher wages, not lower; and more happiness, comfort and wellbeing for the millions.

—J. H. GEPFERT
Reeves Pulley Co.

Brake Works with Power Cutoff

To the Editor:

WHEN a quick-acting emergency stop is necessary or desirable for a machine, correlation of braking action with the power cutoff is mandatory to offer split-second action. An interesting example is found in a bandsaw of modern highspeed type, designed for woodworking, in which synchronous brakes are applied to both wheels of the machine and are operated by a convenient pedal. The interesting point is the interconnection of the pedal with the power source; pressure on the brake pedal simultaneously cuts off the current.

Study of electrical switches and of mechanical linkages adapted to services of this type will doubtless have a much larger place in the future. There will probably be a day when it will be regarded as criminal if a machine is not equipped for stopping in a brief interval of time. In addition, there are production advantages to be gained when a machine can be brought instantly to a stop, instead of being allowed to coast to rest.

—JOHN HYLER
Peoria, Ill.

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Bulletin 1039 • Characteristics *and* Applications

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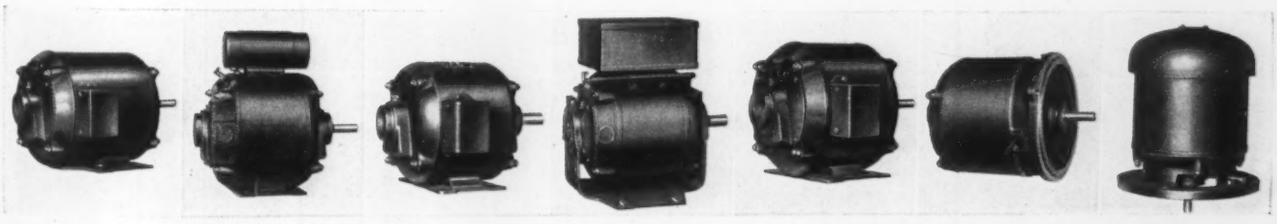


MEN of MACHINES

ACTIVE for many years in the affairs of the American Foundrymen's Association, Hyman Bornstein is now serving as the president of that organization. Director of the testing and research laboratories of Deere & Co., Moline, Ill., Mr. Bornstein is recognized as one of the leading authorities on cast iron.

He was born in Chicago in 1891 and graduated from Armour Institute of Technology in 1911 with a B.S. degree in chemical engineering. He then took a law course in which he won his L. L. B. degree. After serving as a chemist for the Union Pacific Railroad and for Swift & Co., Mr. Bornstein became chemist for the city of Chicago. He resigned to become a captain in the Ordnance Department at the outbreak of the war, joining Deere & Co. following the Armistice.

HYMAN BORNSTEIN

• • •

APPOINTMENT of William J. Davidson of Detroit as general sales manager of the Winton Engine Corp. brings to that position one whose background most decidedly is of an engineering character.

Mr. Davidson, who was born in Montreal in 1891, graduated at McGill University with a B.S. degree in mechanical engineering. In 1914 he joined the engineering department of the Cadillac Motor Car Co., Detroit. With the exception of the war period when he was an officer in the Motor Transport Corps in France, his service with General Motors has been practically continuous since 1914. He has been chief engineer of the Canadian Products division, technical director of General Motors of Canada, executive secretary of the General Technical committee in Detroit and business director of the Research Laboratories.

WILLIAM J. DAVIDSON

• • •

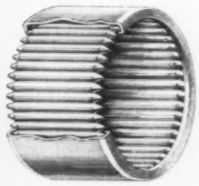
PHILIP G. LANG, JR., who has been nominated to the presidency of the American Welding Society for the coming year, is engineer of bridges for the Baltimore and Ohio Railroad Co. He lives in Baltimore, where he has just been elected president of the Engineers' Club.

Mr. Lang was born in Philadelphia in 1883. He graduated at the University of Pennsylvania with a degree in civil engineering. His first work after finishing college was as draftsman with the American Bridge Co. at Pencoyd, Pa. He joined the Baltimore and Ohio in 1907 as an assistant engineer, became chief bridge draftsman in 1917, assistant engineer of bridges in 1918 and has occupied his present position since 1921.

In addition to his keen interest in professional society affairs, Mr. Lang has for many years been a prolific writer on engineering subjects. As a

PHILIP G. LANG, JR.

A *word about* PERFORMANCE *and this new* NEEDLE BEARING



WHEN the first Torrington Needle Bearing was made about four years ago, it introduced an entirely new principle in bearing design: a complete anti-friction unit with a full complement of needle rolls held within a single compact retaining shell. As its small size required no more space than a bushing, it was felt that its major market would be found in applications where bronze or babbitt bushings would normally be employed.

Of course, at that time, there had been no experience on how this entirely new Needle Bearing would stand up in actual use, so a series of exhaustive tests was made. One of these made a particularly interesting demonstration of the performance of the Torrington Needle Bearing in a rotary application. This summary is from the Torrington Research Department's records.

A Typical Rotary Application

An automobile water pump was selected as the subject of this test because it was believed the bronze bushings in it were not adequate for the high sustained speeds demanded by the modern automobile operator. Packless pumps were being introduced and their success depended on bearings which would not wear and allow the glands to get out of line. It was a simple matter to substitute Torrington Needle Bearings for the bronze bushings and afforded a quick way to make a practical test.

Three pumps were set up with a pulley drive in accordance with the accompanying diagram. The pulley sizes used were the same as regularly used in the make of car from which the pumps were taken. The drive pulley shaft was driven by a 10 H.P. electric motor.

Pump (A) was installed as made by the manufacturer with the regular bronze bushings and equipped with pressure type fittings for lubrication. Pump (B) was fitted with two Torrington Needle Bearings, and pump (C) with one Torrington Needle Bearing, which was placed under the pulley where the greatest load occurs. The remaining bronze bushing was left in place. The shaft carrying the drive pulley was also mounted on Torrington Needle Bearings.

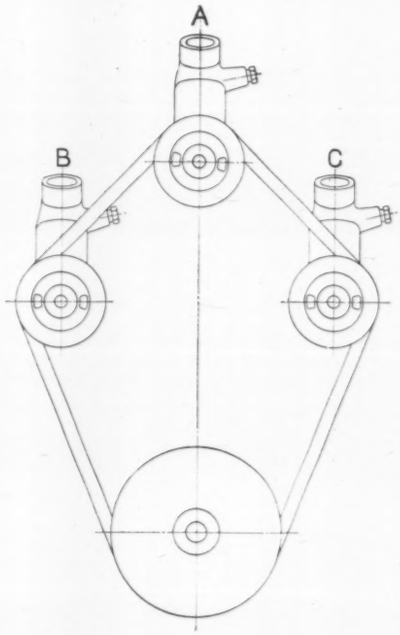
All pumps were connected up to pump water in the regular manner.

The drive pulley was then run continuously at 4200 R.P.M., giving a pump speed of approximately 7100 R.P.M., which was equivalent to a sustained car speed of approximately 100 miles per hour.

This speed was continuous over a 24-hour day, with one stop each 24-hour period for lubrication only. The test ran until the morning of the fourth day when, at the end of approximately 96 hours of continuous operation, the shaft of pump (A), with bronze bushings, had worn through the bushings *and cut right through* the cast-iron pump body so that the pump was a complete failure. Pumps (B) and (C) were found to be in perfect operating condition.

An interesting note is that the belts used averaged 32 hours before breaking. This will give some idea of the extra load imposed in this test and not encountered in actual operation.

Diagram of the Set-up Used to Test the Torrington Needle Bearing in an Automobile Water Pump



Additional Data Accumulated

This test was made over three years ago. Pumps similarly fitted with Torrington Needle Bearings have been operating on the road during the three-year interval with excellent results.

In addition, results of many other tests covering a wide range of commercial uses and based on actual conditions have been accumulated. A representative of the Torrington Engineering Department will be glad to investigate any application you have under consideration with a view to determining the suitability of the Torrington Needle Bearing. Complete information is given in the Needle Bearing Catalog, available on request. Write for Catalog No. 9.

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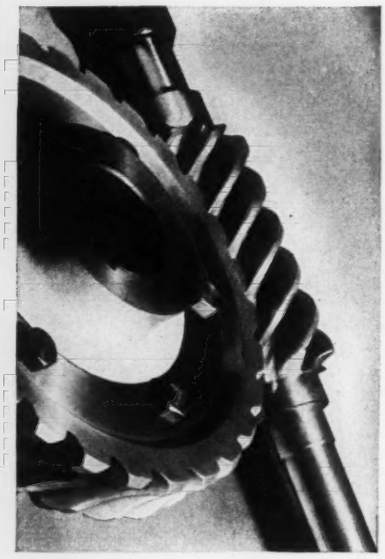
TORRINGTON
NEEDLE BEARING



THEY SERVE FOR *Years*

Each succeeding year lengthens the performance records of some of the earliest Cleveland Worm Gear Speed Reduction Units.

Many of these "old-timers," installed soon after this Company's establishment in 1912, are still located where first installed and are operating continually without letdown, appreciable wear, or need of parts replacement.

This remarkably long life is due to the perpetually smooth action of worm and gear in Cleveland Units. They not only operate in the closest contact when new, but maintain perfect conformity throughout years of steady service.

While your primary interest in "Clevelands" is knowing what they will *do* in the Machine Equipment you design and build, it is also worth your while to know some of the "whys." A District Engineer will gladly consult with you on worm gear drive applications to your present or redesigned equipment. The Cleveland Worm & Gear Company, 3275 E. 80th Street, Cleveland, Ohio.

Affiliate: The Farval Corporation, Cleveland, Manufacturers of Centralized Systems of Lubrication.

CLEVELAND *Worm Gear Drives*

recognized authority in his field he has contributed chapters to several well-known books of reference and reported on the International Railway Congress which was held at Madrid, Spain, in 1930.

♦ ♦ ♦

JOHN E. BECK has been appointed metallurgist of the Pittsburgh works of the Jones & Laughlin Steel Corp.

♦ ♦ ♦

W. H. HARRISON, assistant vice president, department of engineering and operation, American Telephone & Telegraph Co., New York, has been elected president of the American Institute of Electrical Engineers.

♦ ♦ ♦

ROBERT L. SACKETT, for twenty-two years dean of the school of engineering, Pennsylvania State College, State College, Pa., retired on July 1 and plans to devote considerable time to executive and committee work in the several technical societies in which he has long been active. He is a vice president of the American Society of Mechanical Engineers.

♦ ♦ ♦

H. H. WILSON has been made designing engineer for wiring devices at the Bridgeport, Conn., plant of the General Electric Co.

♦ ♦ ♦

E. S. AULT will assume the duties of professor of machine design and head of the machine design department at Purdue university in September. Formerly he was associate professor of machine design at Case School of Applied Science, and taught previously at Cornell, Rice and Lehigh. He is chairman of the machine design committee of the American Society of Mechanical Engineers.

♦ ♦ ♦

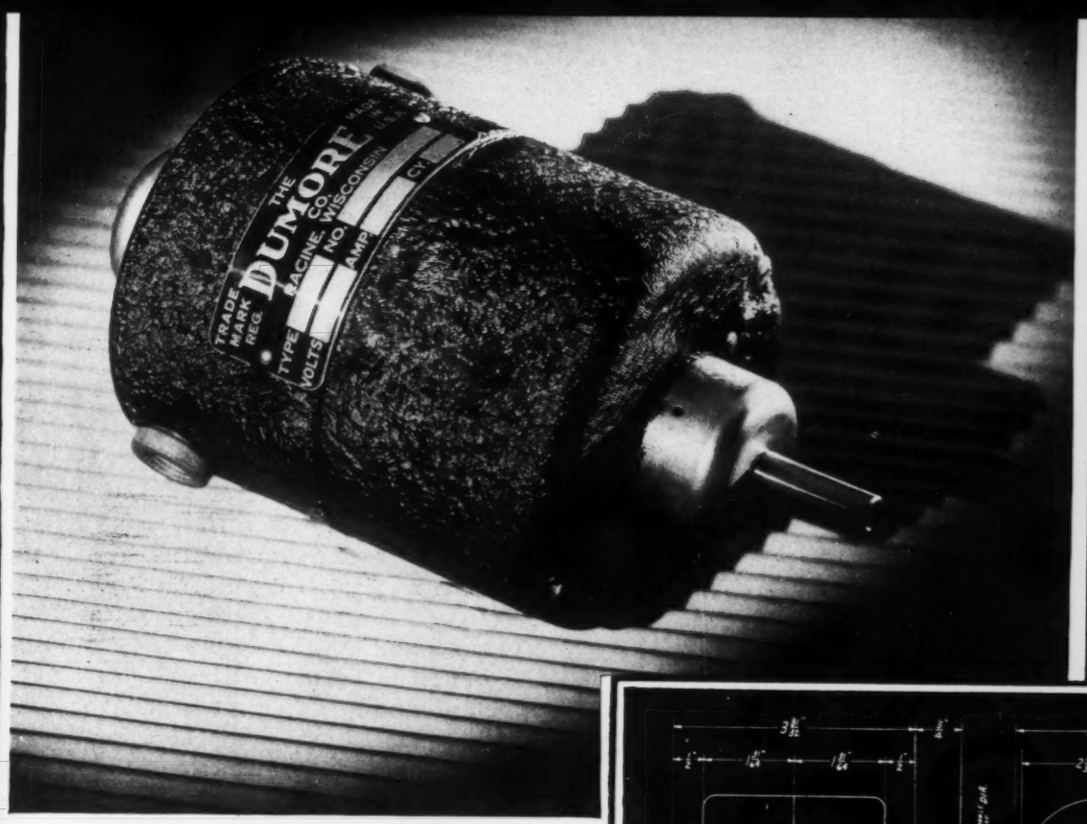
A. L. MARTINEK has been appointed chief engineer of the Delta Electric Co., Marion, Ind. He succeeds L. M. Wiley, resigned.

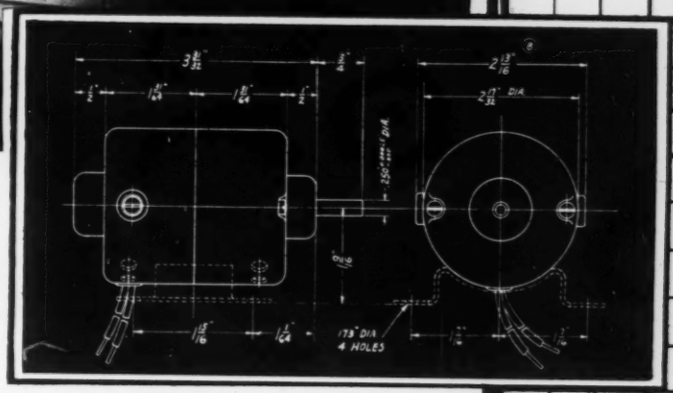
♦ ♦ ♦

RUDOLPH FURRER has been elected vice president in charge of engineering of the A. O. Smith Corp., Milwaukee. (Note: An illustrated biographical sketch of Mr. Furrer appeared on Page 48 of the September, 1936 issue of MACHINE DESIGN).

♦ ♦ ♦

O. E. ROMIG has been appointed chief engineer of the research laboratory, Pittsburgh district, of Carnegie-Illinois Steel Corp. He was formerly a representative in the sheet and strip division of the metallurgical department dealing particularly with silicon steel for electrical fabrication purposes.





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SPECIFICATIONS

	Types H, HB, HM, HBM		Types HV, HBV, HVM, HBVM	
Class of motor	Plain series (univ.)		Plain series (univ.)	
Construction details—				
Degree of enclosure	Totally enclosed		Open	
Method of cooling	Natural		Internal fan	
Bearings	Comp. bronze (self-align.) or grease-packed ball		Comp. bronze (self-align.) or grease-packed ball	
Dir. of rotation (com. end)	Clockwise		Clockwise	
Housing material	Pressed steel		Pressed steel	
Housing finish	Black krinkle enamel		Black krinkle enamel	
Weight	1 lb., 7 oz.		1 lb., 8 oz.	
Rating (full-load)—	A.C. Operation	D.C. Operation	A.C. Operation	D.C. Operation
Volts	115	115	115	115
Amperes	.59	.4	.448	.47
Watts Input	41.5	48	46.5	59
Horsepower Output	1/50	1/38	1/50	1/33
Torque (lb.-ft.)	.017	.0187	.0205	.0257
Full-load R.P.M.	6500	7500	5000	6500
No-load R.P.M.	20,000	20,000	13,200	13,600
Duty	30 min.	30 min.	Continuous	Continuous

Variations

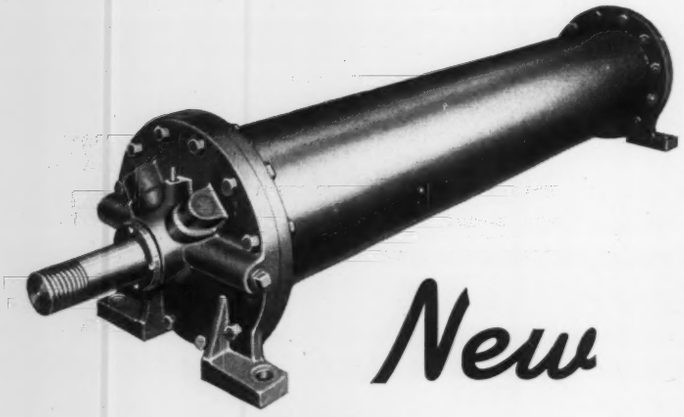
H —totally enclosed, sleeve bearings
HM —totally enclosed, sleeve bearings, mounting base
HB —totally enclosed, ball bearings
HBM —totally enclosed, ball bearings, mounting base
HV —ventilated, sleeve bearings
HVM —ventilated, sleeve bearings, mounting base
HBV —ventilated, ball bearings
HBVM—ventilated, ball bearings, mounting base

Applications

Coin Machines — Blowers
Drink Mixers — Grinders
Erasing Machines
and many other devices of similar nature.

THE DUMORE COMPANY, Dept. 127-H RACINE, WIS.

DUMORE
FRACTIONAL HORSEPOWER MOTORS



New

"LO" Series
Heavy Duty Air Cylinders

● Hannifin extra heavy air cylinders for steel mill and other heavy duty applications combine rugged construction with precision manufacture previously unattainable. The "LO" Series Heavy-Duty cylinder illustrated has 16 in. bore, 7 ft. stroke. The bore is honed to a mirror finish and is straight, round, and concentric, with a tolerance of .001 in. Flanges are screwed on; then welded to the cylinder body. Heads are cast steel, with both ends of stroke air cushioned. Perfect piston fit in a honed cylinder bore means sustained high efficiency and economical utilization of air power.

Hannifin "Heavy-Duty" air cylinders are being made in a full range of standard sizes up to 16 in. bore, for any length stroke, and air pressures up to 250 lbs. Available with or without air cushion at either or both ends. Special sizes built to order. Write for detailed specifications, Bulletin "MD."

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Pneumatic and Hydraulic Production Tool Equipment

HANNIFIN
"Heavy-Duty"
AIR CYLINDERS

Noteworthy Patents

TRANSFERENCE of adhesive from a supply reservoir to the surface of paper or cardboard in a package making machine is the purpose of the mechanism depicted in *Fig.* 1. This is one of the principal features in patent No. 2,082,186 granted to Edwin G. Staude of Minneapolis.

According to the inventor, it heretofore has been common practice to use two gluing devices—one for application to the bottom of a carton "blank", the other to the top. In the case of the latter, the reservoir has been placed above the work line. This is inclined to cause surplus glue to be deposited not only on the work but also on the mechanism.

While in the illustration the disk is shown applying glue to the upper edge of a carton blank, it can be arranged to feed to the bottom edge with equal facility. The edge of the material is related to the periphery of the disk as a chord. Therefore during rotation a diagonal wiping action results. This action, together with the downward slant of the disk into the reservoir, insures a thin even coating of adhesive on the edge of the blank and insures also that the excess adhesive is carried back to the reservoir instead of being deposited on the mechanism or otherwise wasted.

In the patent the inventor mentions several details of construction. For instance, the disk for feeding the adhesive is made separable from its hub, because of the fact that it is desirable that the disk be of

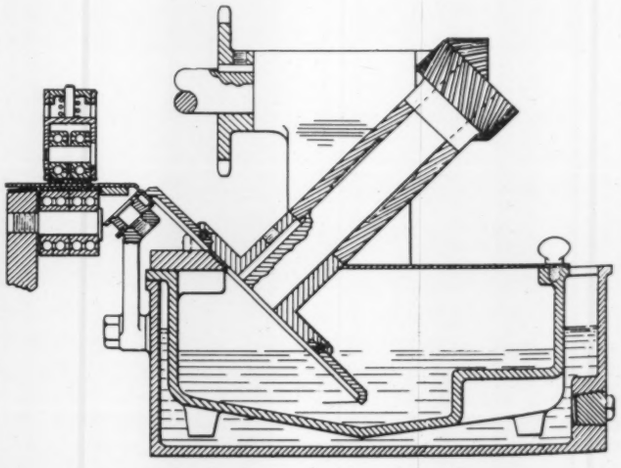
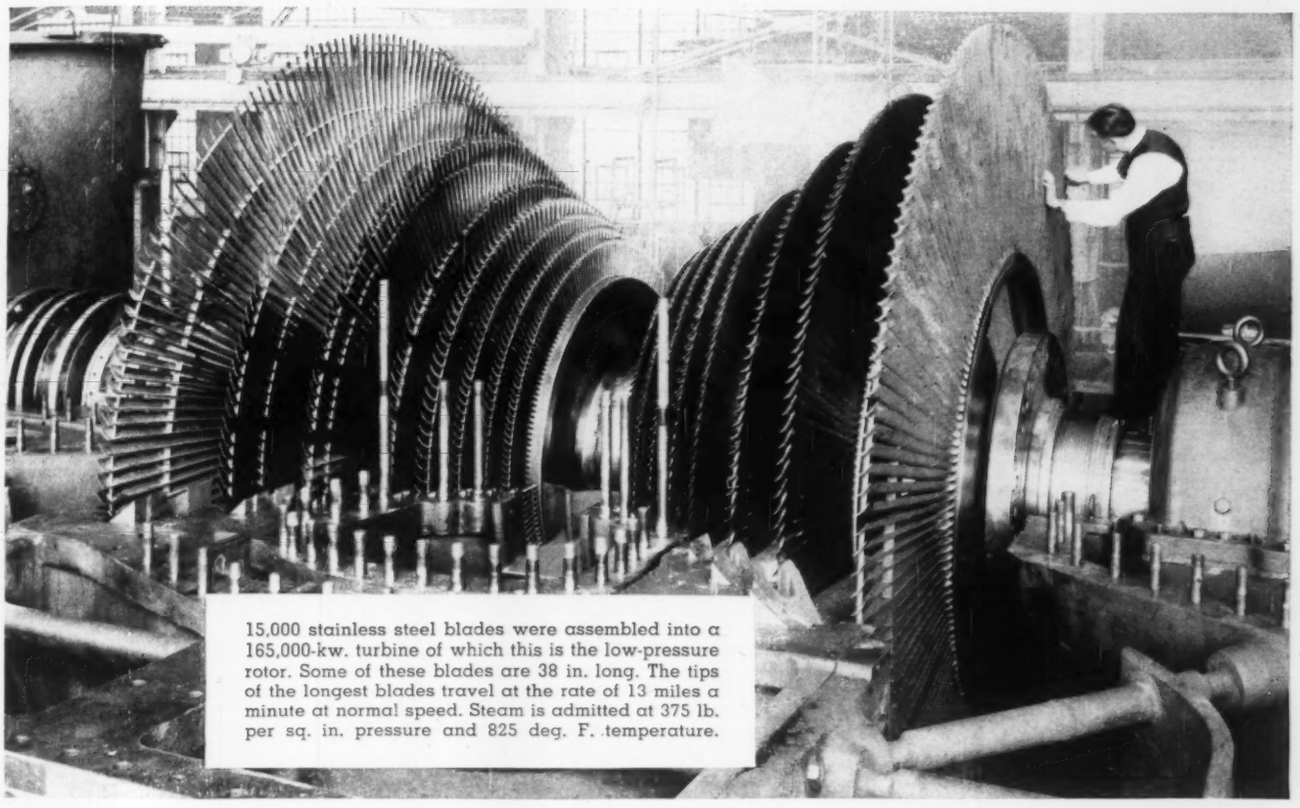


Fig. 1—*Improved gluing mechanism for carton machines has its reservoir below the working line*

Better . . because

IT'S STAINLESS STEEL



15,000 stainless steel blades were assembled into a 165,000-kw. turbine of which this is the low-pressure rotor. Some of these blades are 38 in. long. The tips of the longest blades travel at the rate of 13 miles a minute at normal speed. Steam is admitted at 375 lb. per sq. in. pressure and 825 deg. F. temperature.

ALL the blades of this modern turbine rotor are forged from strong, tough, corrosion-resistant stainless steel . . . This metal withstands the terrific stresses set up when the blade tips travel at more than eleven hundred feet a second and resists corrosion and erosion from millions of minute particles of moisture impinging on it with lightning velocity . . . A better turbine is the result!

In thousands of other applications, stainless steel makes a better product and does a better job. If you want high strength, light weight, heat resistance, corrosion resistance, low maintenance and long life in your equipment or product, investigate the many possibilities of stainless steel.

While not a producer of steel, Electromet produces the ferro-alloys that make stainless steel possible. A vast fund of practical data pertaining to stainless and other alloy steels and the assistance of Electromet metallurgists are available to guide you in selecting a steel suitable for your equipment or product. Your request for this information will not obligate you. Write today.

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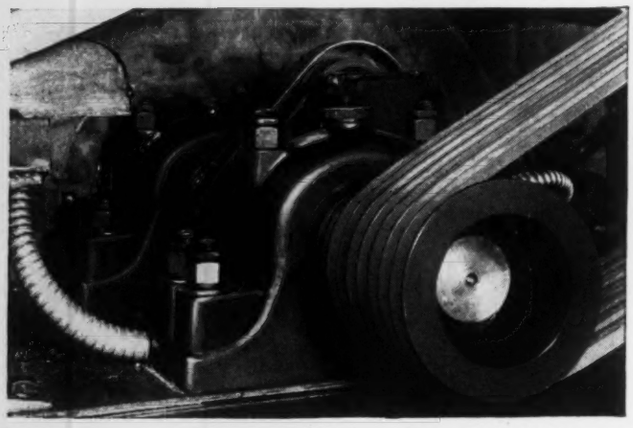

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PROTECT YOUR REPUTATION

That steady, severe service that bearings are bound to encounter "weeds" out the weaklings and brings out the leaders. That is why Dodge-Timken Bearings are widely preferred by machine designers as rugged aids to the uninterrupted performance of the entire unit. Designed and built to insure satisfactory performance under every service condition, these famous bearings protect your good name and reputation. Specify *Dodge*. There's more than half a century of success behind that name.

Let us send you a copy of our bulletin A-205 which describes Dodge Rolling Bearings.

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THE Right DRIVE FOR EVERY JOB

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THERE IS ADDED VALUE IN THE NAME DODGE

special acid-resisting metal, whereas the hub can be made of much less expensive material.

Attention also is called to the use of a grooved wheel in cooperation with the adhesive transfer flange of the disk. The purpose of this is to enable this wheel to "straddle" the flange when no blanks are passing through, so that no glue is transferred.

Drive to the sprocket is by chain from one of the feed shafts of the machine and—as is evident from the drawing—spiral bevel gears are used.

Explosions Operate Hammer

AN interesting adaptation of the internal combustion engine to the powering of a hammer is the subject of a patent recently granted to Thomas C. Gray of Evanston, Ill. This patent—which is No. 2,083,261—has been assigned to the Barco Mfg Co.

Heretofore internal combustion hammers having springs for returning the pistons have had these springs mounted inside the cylinder below the piston. Thus they are subjected to considerable heat, they are not conveniently accessible for replacement, and they require a long cylinder. In the sectioned assembly of the improved hammer, reproduced herewith as *Fig.* 2, it will be noted that the return spring is housed in a separate chamber located above the piston, connection being by a drawbar which passes through the cylinder head.

The piston has at its lower end a striking block which at the end of the stroke hits the top of the anvil into which or against which the tool (a drill, tamper, concrete breaker or similar implement) is seated. The anvil housing and the anvil contained therein serve to close the bottom of the cylinder and afford between the bottom of the piston and the top of the anvil and housing a precompression space in which the combustible mixture is compressed by the power stroke of the piston. When the top of the piston drops below the recess in the cylinder wall, the mixture by-passes around above the piston.

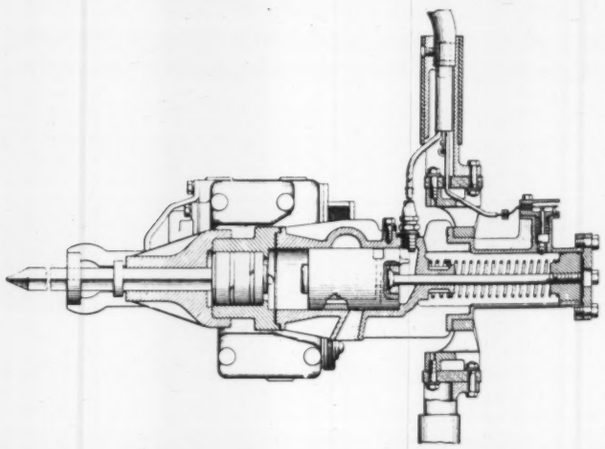

Fig. 2—Internal combustion hammer has separate chamber for housing its piston-return springs

CAN YOUR PRODUCT *Write home* FROM ITS JOB ?

When your product goes to work in the field, can it let you know how it's getting along . . . whether it's living up to the family name? Yes, you can get the life story of every unit you sell — if you have built in a Veeder-Root Counting Device.

You'll get a *truthful* report of performance from the first day on the job. *Veeder-Root figures don't lie,* because the counter is made for permanent accuracy . . . may be built in as an integral part of the machine . . . can be made dust-proof, tamper-proof. These figures serve you in three ways. They show your customer he's getting his money's worth . . . show prospective customers what *they* can expect. And they definitely prove the right or wrong of any servicing claim.

Could *your* product write home from its job? It's worth while finding out. And be sure you're right — for counter applications are seldom obvious at first glance . . . usually require a trained eye to spot them. That's a job for a Veeder-Root engineer, and it carries no obligation. Any time you say. Write.

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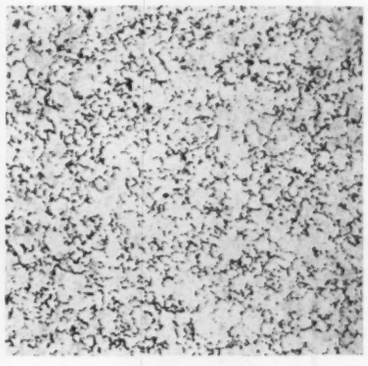
A BETTER MOTOR

NEW *Materials and Parts*

New Steel Easily Machined

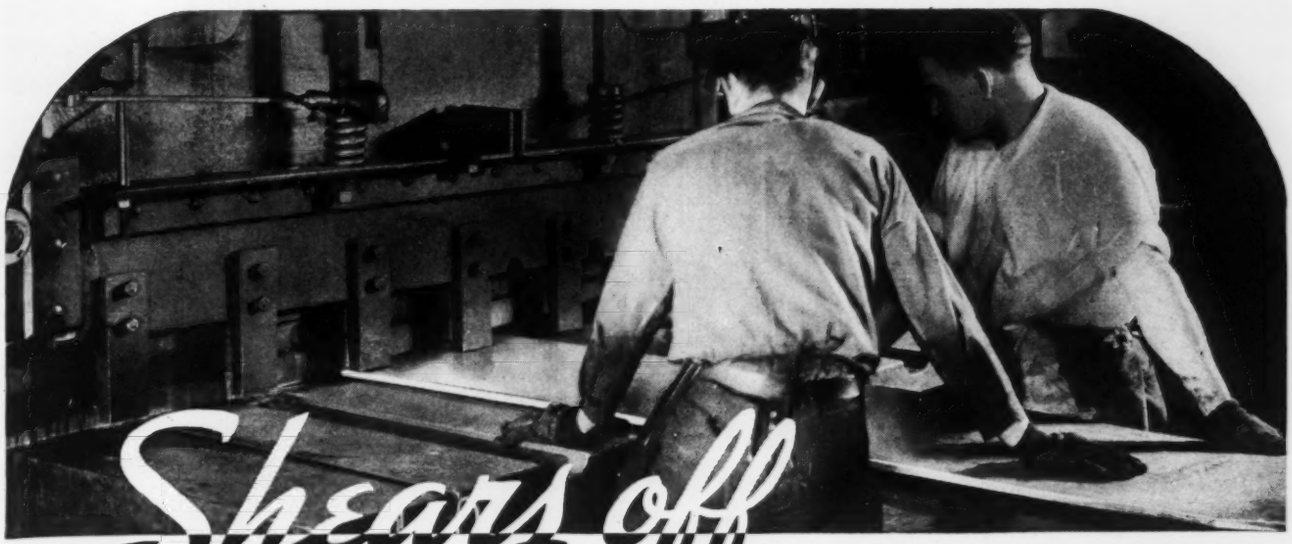
DEVELOPED to reduce the cost of carburized parts for applications where the core properties of the expensive carburizing steels are not essential, a new steel, known unofficially as S.A.E. 4120, has been placed on the market by Climax Molybdenum Co., 500 Fifth avenue, New York. Characteristics of the steel include excellent machinability, good core properties, may be quenched from the box with minimum, uniform distortion, and takes a hard, wear resistant case. "4120" lends itself to a wide variety of applications, particularly where exceptional wear resistance is required. A partial list of parts already made includes medium and heavy-duty gears and pinions, automotive hypoid gears, wristpins, worms, sucker rod couplings, shafts and antifriction bearings.



Grain size of the new 4120 steel, A. S. T. M. standard E19-33, sodium picrate etched

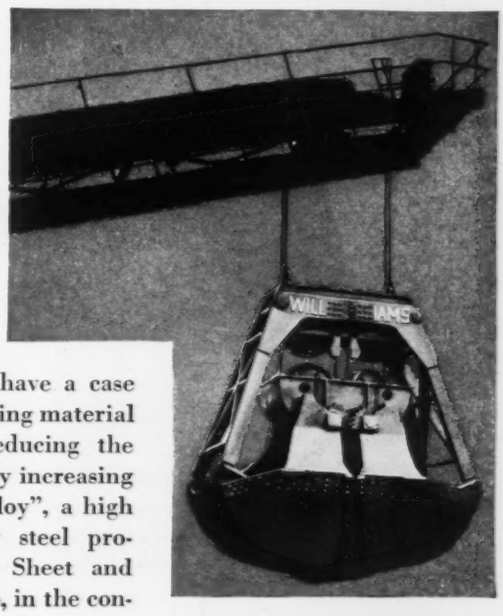
Lubricator Has Tiny Reservoir

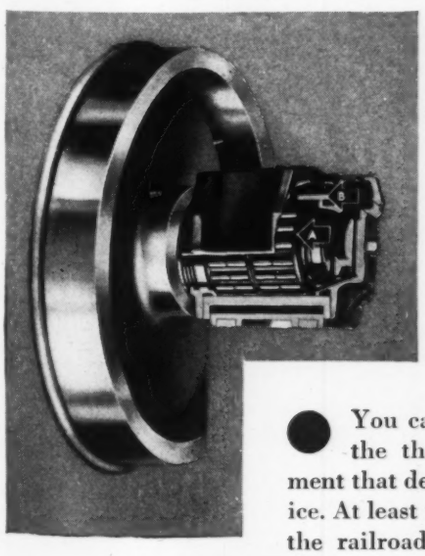
SUPPLEMENTING the general line of lubricators having reservoir capacities from one to six pints, Bijur Lubricating Corp., Long Island City, N. Y., has recently released a model, type L, with a reservoir capacity of one-quarter pint. Heretofore "one-shot" lubricators have been designed for pump discharges of from 30 to 900 drops of oil. On many small machines, however, the amount needed is about 10 drops. This new model meets the lower range in a simple manner. A small lever is provided on the unit, which when pressed raises the piston through a definite stroke, thereby drawing a definite volume of oil into



Shears off NEEDLESS COSTS *and* NEEDLESS WEIGHT

● The trouble with costs is you can't tell how much is *needless* until there's a basis for comparison. But here's one that ought to be interesting to every user of tool steels. The shear blade pictured above operating on hard alloy steel stock was formerly made of carbon tool steel. After cutting 200 to 500 pieces, however, the blades regularly became spalled or broke out at the edges. But after the Henry Disston Steel Works furnished blades made of their "827" medium carbon Nickel-chromium steel, the average service life jumped to 3,000 to 6,000 cuts between grinds with no spalling or breakage. Nickel steel not only sheared more parts but sheared off needless cost.





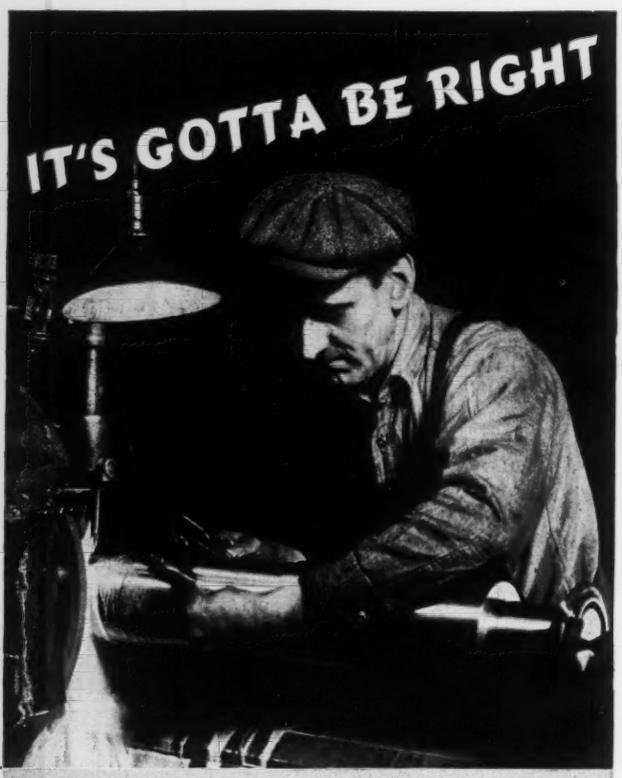
● Here at the right we have a case where the cost of handling material was appreciably cut by reducing the weight of equipment, thereby increasing the pay load. By using "Yoloy", a high tensile Nickel-copper alloy steel produced by the Youngstown Sheet and Tube Co., Youngstown, Ohio, in the construction of this large breakdown coal bucket, its pay load capacity was increased from 6 to 7 tons without increasing its gross weight.

NICKEL
ALLOY STEELS

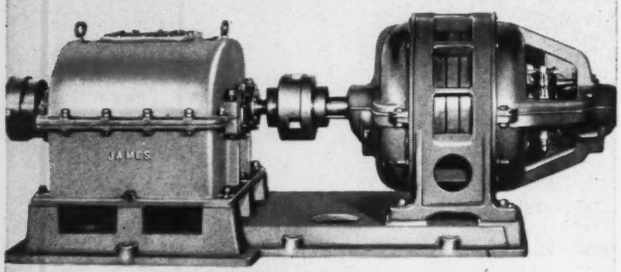
● You can't help but have respect for the thrift of transportation equipment that delivers a *million miles* of service. At least that much mileage is given by the railroad coach journal bearing pictured at the left, a type that is used by 24 leading railway lines and manufactured by The Fafnir Bearing Co., New Britain, Conn. Among the reasons are the inner race (A) made of shock-resisting Nickel-molybdenum carburizing steel and the housing bore (B) made of wear-resisting Nickel Cast Iron.

We invite consultation on the many ways in which the Nickel Alloy Steels will help to reduce operating and maintenance costs.

THE INTERNATIONAL NICKEL COMPANY, INC., NEW YORK, N.Y.



"Twenty years ago, about the time I had finished my apprenticeship, I remember the boss telling me —'Gus, it's gotta be right,' and I never had a chance to forget it. Our inspection department is mighty tough—they check the finished article against the prints and, also, test it for days...To save time and grief my slogan will always be 'It's gotta be right'."



D. O. James Continuous-Tooth Herringbone Reducers make possible the most efficient gear ratio for each given operation as affects efficiency and power economy . . . We are exclusively equipped with Sykes Continuous-Tooth Herringbone Gear Generators —generating gears up to 49 inches.

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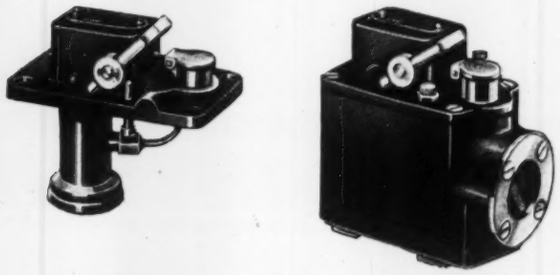
D. O. JAMES

MAKERS OF EVERY TYPE OF SPEED REDUCER AND CUT GEAR

the pump cylinder. On release of the lever the metered quantity of oil is discharged into the tubing system. In spite of its compactness the type L



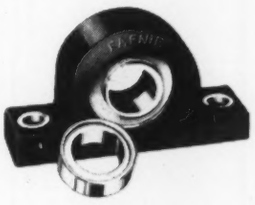
Small piston draws definite amount of lubricant into cylinder, insuring metered quantity

equipment incorporates such Bijur features as filtered oil, metered lubrication, instant feed and a closed system.

Pillow Block Has Wider Bearing

ADDITION of a wide inner ring ball bearing with self-locking collar to the recently-developed Fafnir rubber pillow block has been announced by the Fafnir Bearing Co., New Britain, Conn. The combination of a quiet, friction-free ball bearing mounted in a pillow block of resilient, live rubber provides the means of eliminating noise from such parts as fans and blower rotors. In this new design the shaft is slipped through the bearing unit, the self-locking collar is engaged and turned, and the set screw tightened.

Live-rubber mounting of ball bearing eliminates noise



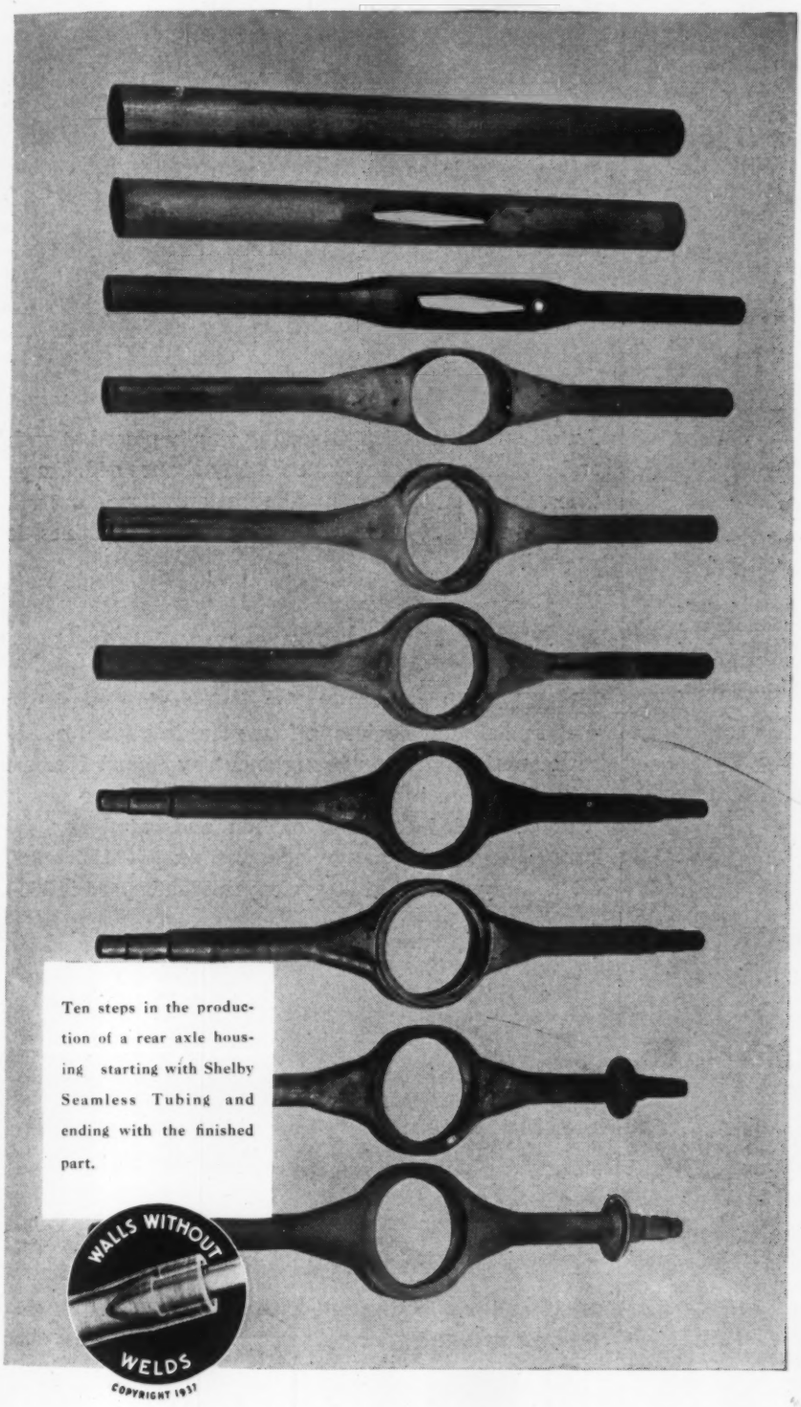
Built for English rather than metric dimensions, the bearings readily fit standard shafts without machining. Pillow blocks are offered in sizes ranging from ½ to 1 7/16-inch bores, providing for all shafts usually found in household heaters, air conditioning and general heating and ventilating applications.

Control Valve Announced

SEVERAL special features distinguish a new line of hydraulic control valves placed on the market by Logansport Machine, Inc., Logansport, Ind. Body of the valve is so designed that it may be rotated in

(*Continued on Page* 68)

THE RIGHT START for successful parts



Ten steps in the production of a rear axle housing starting with Shelby Seamless Tubing and ending with the finished part.

...begin with SHELBY TUBING

FRONT and rear axles, housings, drag links, tie rods, torque tubes, brake cross shafts, body and seat framework — leading automotive manufacturers make these parts from SHELBY. And here's the reason why.

Automotive engineers *know* SHELBY from the inside out. Many of them have worked with it, built with it, designed with it. They have seen it perform in the machine shop, on the production line, and finally in service. They know that SHELBY has what it takes for automotive parts.

Their confidence in SHELBY is well placed. Selected steels, expert metallurgical supervision, control of manufacture from ore to finished tubing, rigid inspection and tests in every stage of production — these factors insure its thorough uniformity, ductility, and strength. That is why the name SHELBY stands for tubing of distinction . . . why you are right from the start when you begin with SHELBY.

SHELBY is available in round, square, rectangular, oval, and other shapes — all practical sizes, lengths, and wall thicknesses—various finishes and many grades of carbon and alloy steels. SHELBY can also be furnished in special forms and shapes—literally "Tailor-made" to your specifications —to speed up production and cut finishing costs.

Whenever you are considering changes in designs, send us your drawings and specifications. Our engineers are specialists in tubular construction. Their recommendations frequently result in better parts at lower costs.

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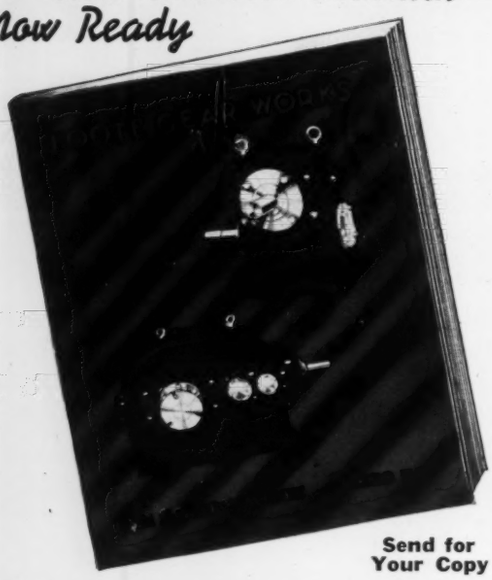
Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

Brad Foote's New Reducer Manual Now Ready

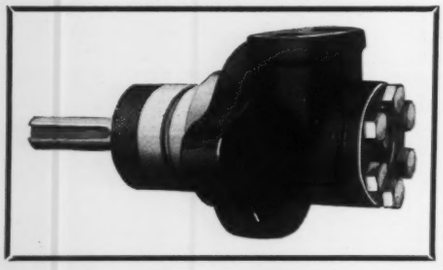


Send for Your Copy

The Brad Foote Reducer Manual has been scientifically compiled, making it easy to obtain ratings and dimensions at a glance. The book is especially useful in obtaining new thoughts in the power transmission field and will be definitely helpful in solving your problems for power transmission.

FOOTE GEAR WORKS, INC.

1301-G. S. Cicero Avenue — Cicero, Illinois



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Serve the Industry

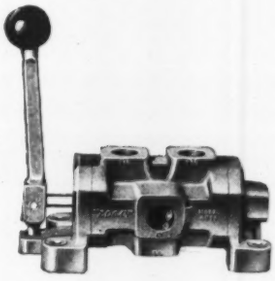
The small, efficient Viking Fuel Oil and Lubricating Oil Pump has been designed for direct connection to your machine. It is obtainable in 2/3, 1½ and 3½ gallon per minute sizes. Viking's basic principle, "A Gear Within A Gear", makes this pump self priming, assures positive displacement. Get the Facts. Write for illustrated bulletins and prices.

VIKING PUMP COMPANY
CEDAR FALLS, IOWA

(*Continued from Page* 64)

relation to the end covers for different mountings. The valve body is made of chrome nickel insuring long wear and resistance to corrosion. Piston is balanced and accurately machined and ground for correct fit.

Valve body is so designed that it may be rotated in relation to end covers for different mountings

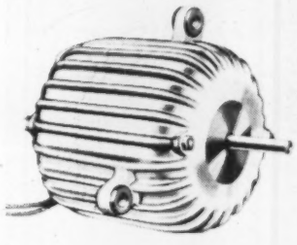


An oil and heat resistant sealing ring is placed at each end of piston shaft to eliminate any chance of leakage. The valve is suited for any application where start and stop control of hydraulically-operated machines is needed.

Motor Suited for Special Needs

DESIGNED especially for hair-drying machines and similar devices, a four-pole, fractional horsepower motor has been brought out by Signal Electric Mfg. Co., Menominee, Mich. Known as type QN-1, it is of shaded coil construction and rated at 1/30 horsepower. The motor operates on 110-120 volts, alternating current at 60 cycles; full load speed is 1600

Grease packed bearings reduce need for periodic lubrication



RPM and no load speed 1700 RPM. A feature of the motor is the grease-packed bearings which reduce the need for periodic lubrication. The motor is available as type QB-1 for direct current.

New Coupling Is Developed

OF FULL-FLOATING, semi-universal joint design a coupling, known as the Rybeck flexible coupling, which compensates for extreme shaft misalignment in direct drives has been developed by T. L. Smith Co., Milwaukee, Wis. The coupling is one of the few on the market which takes care of shaft mis-

157,680,000 Contacts

AND STILL GOING STRONG!

KON-NEC-TORS

"For over five years," said this manufacturer, "we have used General Electric KON-NEC-TORS. We have had such good service from them that I feel they have been giving our displays a record for dependability. We like to send displays out as nearly fool-proof as possible.

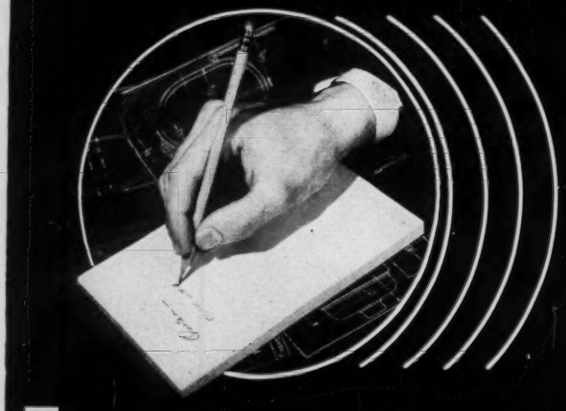
"General Electric KON-NEC-TORS have proved themselves to be unaffected by millions upon millions of makes and breaks of current. One unit we used for demonstration has been running steadily twenty-four hours a day without interruption for five years. It completes a cycle every second, and a total of 157,680,000 contacts and breaks over that period. It's still going strong!"

Service without failure is one of the outstanding features of KON-NEC-TORS. They are fool-proof and wear-proof . . . require no maintenance . . . are easily adapted to use where the utmost reliability, quiet operation or long life are requisites. For full details address the General Electric Vapor Lamp Company, 825 Adams Street, Hoboken, N. J.

GENERAL ELECTRIC
VAPOR LAMP COMPANY

839-K

"Attached is a Blueprint-"



This phrase occurs frequently in our incoming mail; it is the practical inquiry into the comparative costs of parts fabricated from WILMINGTON VULCANIZED FIBRE that dozens of keen executives are making. As a result, we are often able to repay them for what is, after all, but a few minutes trouble, by pointing out savings that may run into substantial amounts.

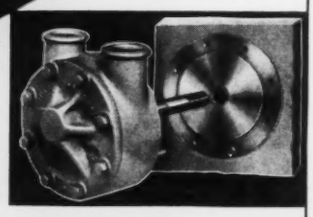
May we suggest that you, too, send us blueprints or detailed sketch? We'll tell you frankly what we can do. And, there is no obligation at all.

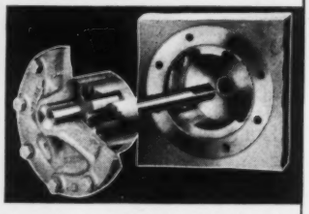
WILMINGTON FIBRE SPECIALTY COMPANY

MANUFACTURERS OF GENUINE VULCANIZED FIBRE

WILMINGTON, DELAWARE

BUILD the PUMP INTO Your Machine





Tuthill "Stripped" Pumps enable you to incorporate the pumping elements directly into the design of your machine.

Complete line available for coolant, lubrication, hydraulic mechanisms and general purpose. Capacities up to 50 g.p.m. Wide pressure range.

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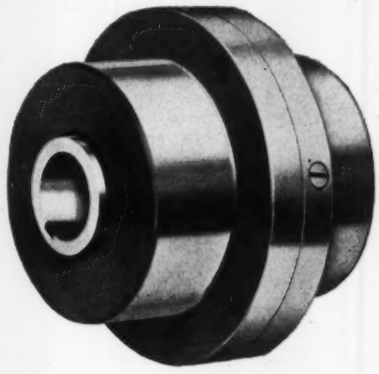
For information on pumps illustrated, send for Tuthill "Stripped" Pump Bulletin

alignment, offset between shafts, end play and shock, without increasing bearing loads. Torsional load in the coupling is transmitted through groups of laminated springs. These springs are not subject to wear from endwise motion of the shafts, nor from



Laminated springs carry torsional load in this universal joint type coupling

angular or offset misalignment. Special alloy steel driving pins are pressed into steel hubs and fit into holes drilled into the torque sleeves. The sleeves are held in alignment by the housing which is securely bolted together.

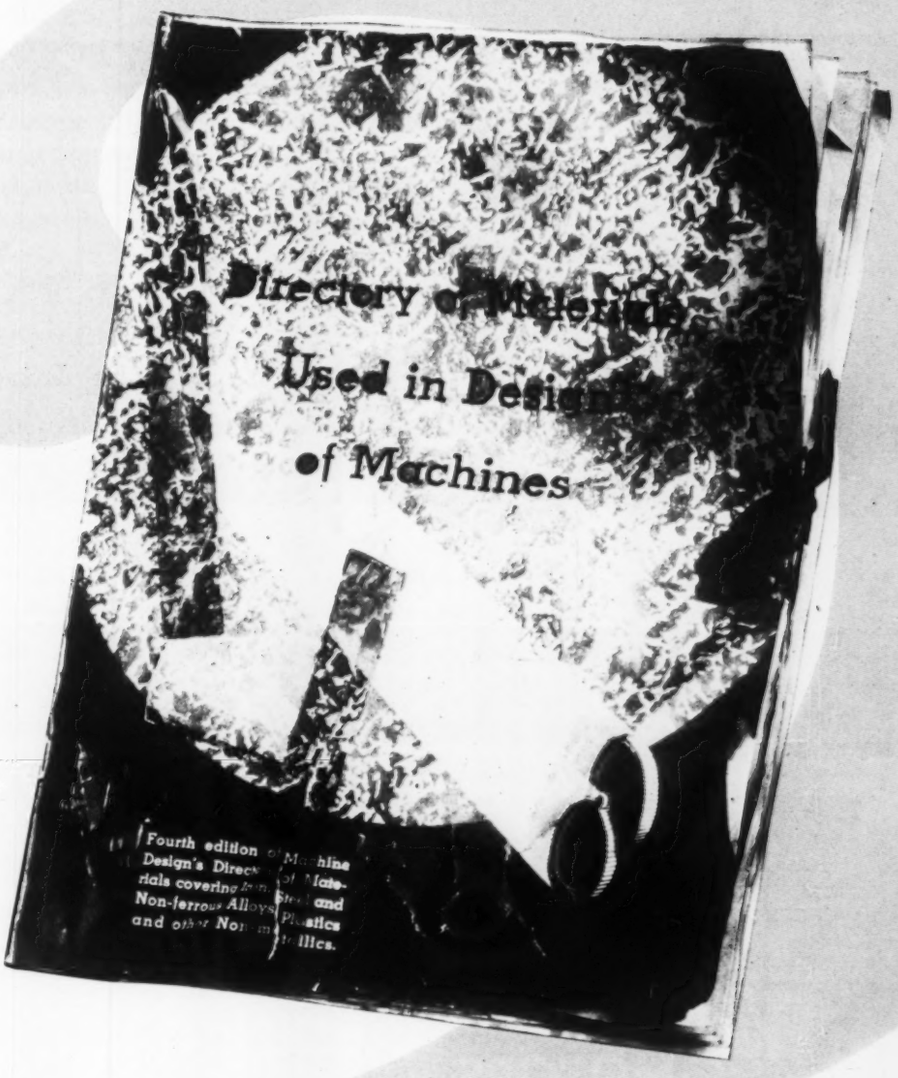
Valve Vents Air in Steam Systems

DESIGNED for automatically venting driers, steam coils, traps and similar equipment under operating pressures up to 150 pounds per square inch, a

Sensitive thermostat closes valve at 212 degrees Fahr., keeping it closed until temperature drops

high pressure air eliminator has been placed on the market by Gorton Heating Corp., Cranford, N. J. Operating member of the unit is made of a noncor-

(*Continued on Page* 74)



Every regular reader of MACHINE DESIGN will have available a copy of the Directory of Materials as a part of the October issue. Additional copies of the Directory may be secured at twenty-five cents each. Hundreds of additional copies were sold following publication of the Fourth Edition. To assure yourself sufficient copies for members of your staff, we suggest you place your order in advance.

• • •

Manufacturers of Alloys, Plastics and other Engineering Materials may augment their necessarily condensed listings with display space, in which application photographs and detailed descriptive matter concerning their products can be shown if desired. For further information write MACHINE DESIGN, Penton Building, 1213 West Third Street, Cleveland, Ohio.

MACHINE DESIGN

PARTS • MATERIALS • METHODS • FINISHES

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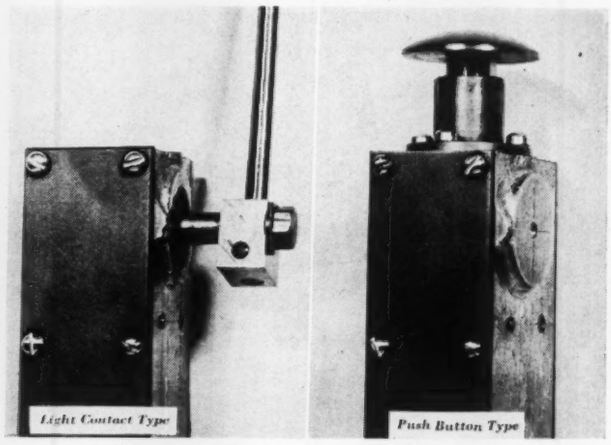
MINIATURE MOTORS—a complete line of dependable "flea-power" motors, cased, semi-cased and skeleton types for all 110 V. currents. Sturdy, cool-running motors for a 1000 different uses, with or without speed reducers. A complete line including multi-purpose unit (as illustrated) complete with quiet worm-driven speed reducer, that can be assembled to drive up or down, right or left, to deliver any speed. Other complete Back-geared units that weigh but 10 ounces. Many Types. One or a million on short notice.
WRITE FOR CIRCULAR
SPEEDWAY Manufacturing Co.
1858 S. 52nd Ave. CHICAGO, U. S. A.

(*Continued from Page* 70)

rosive metal that is very sensitive to heat changes. At 212 degrees Fahr. the operating member closes the valve and keeps it closed until the temperature falls below that point, when it automatically opens the valve. The body of the eliminator is made of bronze, nickel plated. It is 2½ inches in diameter and 4⅝ inches high with a ½-inch bottom pipe connection.

Switch Line Introduced

FIVE different switch models are available in a new line developed by The National Acme Co., 122 East 131 street, Cleveland. The units may be used as a limit switch, safety switch, or in connection with counting devices, circuit breakers, liquid level controls, gage devices and similar applications. Two of the five types are illustrated. In addition to the light contact and pushbutton types there are the rotary,



Extremely light touch serves to actuate switch on left; other type makes contact with short plunger movement

plunger and oscillating types. Oilseal ball bearings support the shaft in the light and rotary type switches. Electrical contacts in all models are the dustproof, fully enclosed unit made by the Micro Switch Corp. The switches are designed for alternating current operation, but may be used with direct current if suitable condensers are provided.

Friction Reduced in Valve

MADE of either ferrous or non-ferrous materials, depending upon the type of service, a balance diaphragm valve has been developed by the McAlear Mfg. Co., 1901 S. Western avenue, Chicago. This valve is said to close tight in service on fluids or gases containing foreign matter or dirt particles. Being balanced, it will open or close easily. There are no bellows or stuffing boxes, thus reducing friction to a minimum. When used in throttling service there

(*Continued on Page* 78)

Sleeve BEARING DATA

The DESIGN of SLEEVE-TYPE BEARINGS

THE first step in bearing design is the selection of the TYPE of bearing to suit the application. Such factors as speed, load, method of lubrication and any unusual features as shock, impact, corrosion, etc., must be definitely determined. Likewise we must give consideration to the shaft — not only its size but also its material, and the housing.

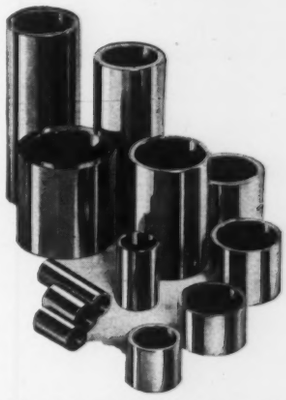
With complete operating data at hand we can readily choose the correct type from the many and various sleeve bearings available. For instance, internal combustion engines perform best on laminated bearings. Applications where end thrust is present often require the addition of a flange. The lubrication method might be helped considerably by the judicious use of grooves or slots.

The most satisfactory proportions for any sleeve bearing is to have a length one and one half times the diameter. This provides ample bearing surface over which the load can be equally distributed. Where the application requires a bearing of greater length, it is often a good plan to employ two separate bearings. In so doing, the small intervening space can often, with the proper oil intake and grooves, act as a reservoir.

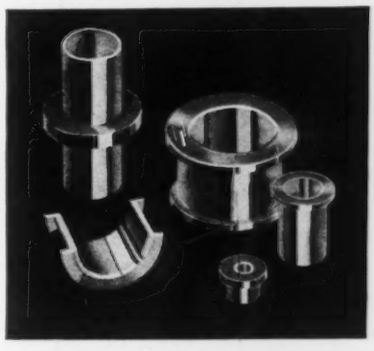
In applications where it is necessary to use a bearing of shorter proportions, an oil seal will be of considerable help.

In determining the amount of clearance necessary, we must take into consideration the method of lubrication and the type of lubricant. For satisfactory operation of the motive unit we must be able to establish a film of lubricant between the inter-face of the load area. It is obvious that if a shaft, under load, is to be separated from the surface of the bearing, the film pressure must be in excess of the static load imposed upon the shaft. Film pressure is created by hydrodynamic action, by virtue of the rotation of the shaft and the viscosity of the lubricant.

Recesses in the outside diameter can often be utilized as oil reservoirs.



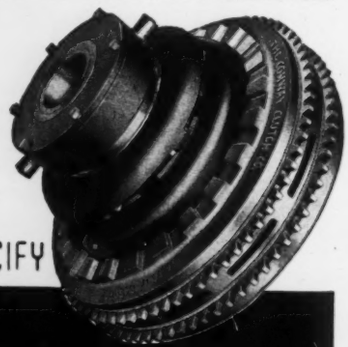
Whenever possible, it is economical to use bearings of standard dimensions. Over 700 sizes of plain bearings are available from stock.



Flanges, to take up end thrust, can be placed practically anywhere on the outside diameter.

JOHNSON BRONZE COMPANY
525 SOUTH MILL STREET • NEW CASTLE, PA.

Sleeve BEARING HEADQUARTERS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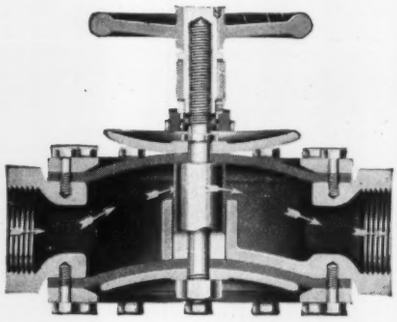
Powerful . . . . built to "take it." That describes the Conway Patented Series 390 Tandem Plate heavy duty clutch. Gear tooth drive through adapter. Designers of machinery will find the rugged, compact design and smooth operation meet their most exacting requirements. Write now for Bulletin L 28. It contains full details including prices.

THE CONWAY CLUTCH CO.

1546 Queen City Avenue
CINCINNATI OHIO

(*Continued from Page 74*)

are no bad effects from wire drawing. Diaphragm may be changed to take care of gas, air, water, acids or alkalis without removing the valve from the line.

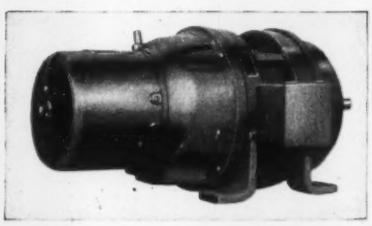


Friction is reduced in this valve by elimination of stuffing box

It will operate in any position, is not damaged from freezing and can be either hand or motor operated.

Motor and Brake Combined

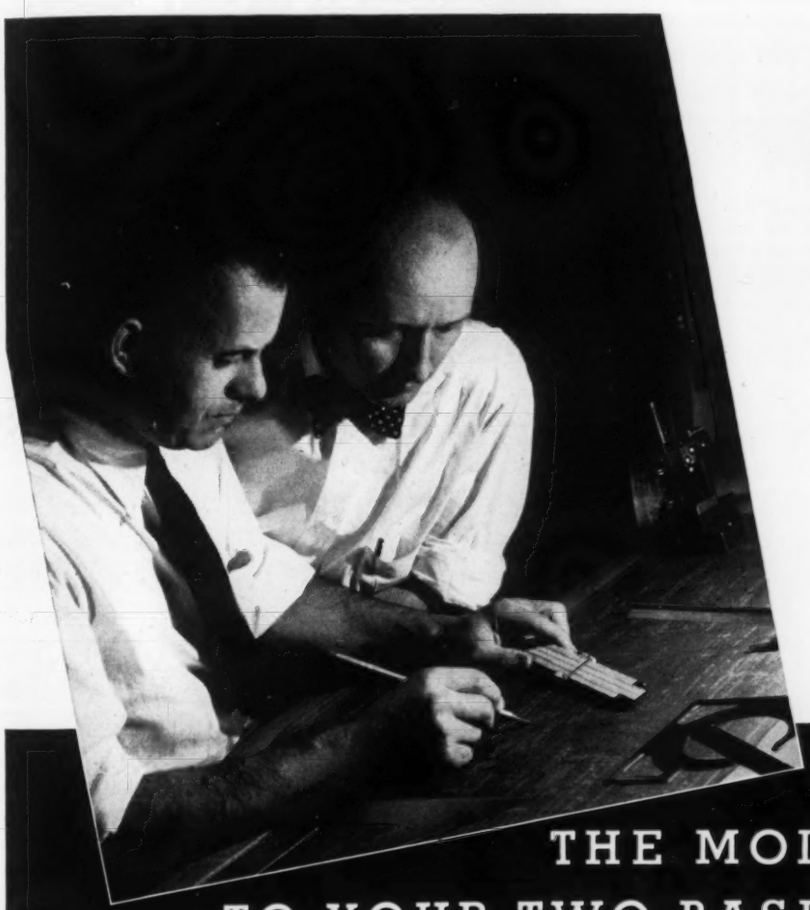
FUNCTIONS of a motor and brake are combined in a single unit, known as the "disk-brake" motor, now made available by The Reliance Electric & Engineering Co., 1088 Ivanhoe Road, Cleveland. The unit is useful for small cranes, hoists, auxiliary movements on machine tools and other equipment in which quick, automatic and accurate stopping or holding of a load is necessary. The brake consists of a compact disk-type friction device, mechanically and automatically engaged when the current is off and magnetically disengaged when current is applied. A "wear-indicator," combined with the manual brake release mechanism, gives warning whenever there is excessive wear. The brake mechanism operates equally well in any position and may be fitted with any standard Reliance motor except those of the fan-cooled type.



Compact, disk-type friction brake stops and holds motor armature under heavy loads when power is off

Rivet Is Applied from One Side

MACHINE fabrication is simplified with a front drive rivet which is applied by one operator from one side of work. Introduced by Multi-Seal Mfg. Co., 123 N. Jefferson street, Chicago, the new type of rivet is said to be as strong as the ordinary type nut and bolt. The rivet is driven in the hole and a nut drawn



HOW TO HANDLE IT

IF *IT* IS DESIGNING CHAIN DRIVES

THE MODERN ANSWER TO YOUR TWO BASIC PROBLEMS—

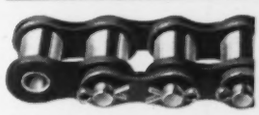
When designing a modern chain drive, you are faced with two basic problems—what chains to use and how to apply them.

The first of these is solved when you choose one of the many Rex Machine Drive Chains. Designed by men backed by 45 years of experience in the development of superior machine drive chains—built by craftsmen, of modern metals—you can depend on them to give you the low-cost, dependable power transmission that *you* want.

There is no better way to assure yourself of efficient chain application (your second problem) than to consult with Rex Engineers. Working in conjunction with you and your engineers, they are able to give you the direct benefit of their long and varied experience—a benefit that is directly reflected in your finished machine.

Investigate the added advantages of Rex Machine Drive Chains. See the Rex man or write today. Main office address, 1643 West Bruce Street, Milwaukee, Wis.

REX MACHINE DRIVE CHAIN



REX ROLLER CHAIN

REX CHABELCO CHAIN

REX DETACHABLE CHAIN

REX GRIPLOCK CHAIN

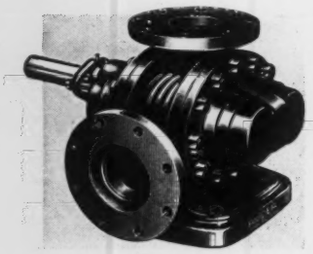
REX

CHAIN BELT COMPANY OF MILWAUKEE

Chain and Belt Conveying

ROTARY PUMPS
for
HYDRAULIC POWER APPLICATIONS
by ROPER

Full Ball Bearing Design — 909 Series — Capacity, 10 to 50 G.P.M. Pressure, 750 lbs. — 996 Series — Capacity, 4 to 200 G.P.M. Pressure, 300 lbs.



Sleeve Bearing Design—997 Series —Capacity, 80 to 700 G.P.M. Pressure, 100 lbs. (lubricating liquids) 40 lbs. (non-lubricating liquids).— 999 Series—Capacity, 1 to 500 G.P.M. Pressure, 100 lbs.

Equal size gears operate at same speed . . . accurately generated gears . . . extra long large bearings . . . carefully machined case . . . rugged cast-iron construction.

Fig. 999

Write for Bulletin R5MD

GEO. D. ROPER CORP., ROCKFORD, ILL.

QUALITY AT LOW COST

NICE
TRADE MARK
REG U S PAT OFF.

NICE
Ball Bearings

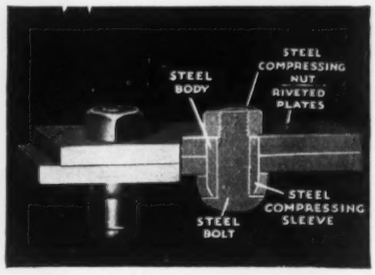
have for more than a third of a century served machinery and equipment manufacturers with unfailing and uniform performance.

Precision thrust bearings, pressed steel ball bearing sheaves, pressed steel full ball bearing casters, precision angular contact type bearings, combination radial and thrust bearings and a great many special anti-friction assemblies made to specifications.

A seventy-page reference book illustrating standard bearings and giving valuable bearing data is available . . . Write for your copy today.

NICE *Ball Bearing* CO.
2955 HUNTING PARK AVENUE
Philadelphia NICETOWN Pennsylvania

up. The steel compressing sleeve is drawn down over the shank and forms a steel rivet, sealing head on the inside or blind side of the job, and leaving only the nut on the outside of work. Such applications as attaching flanges, bracket's and boxing sections, have found a wide use for this type of fastener.

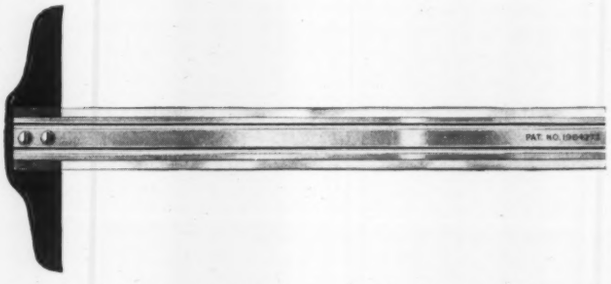


Only one operator is required to apply this mechanical type rivet

Engineering Department Equipment

Stainless Steel Used for T-square

THE advantages of metal plus transparent edges are incorporated in a stainless steel T-square brought out by Turner Devices Inc., 1212 Mississippi avenue, St. Louis, Mo. Double channel construction insures rigidity and perfect accuracy and thin cross-section makes the instrument easy to work over. Finish cannot wear off or rust, being solid stainless steel. Transparent edges are secured to blade by dovetail joints which eliminates the use of cement or other bonding material. The T-square rests on two rounded surfaces that will not soil or scratch work. Sizes of the new device range from 12 to 96 inches and several models are available for use with drafting machines.

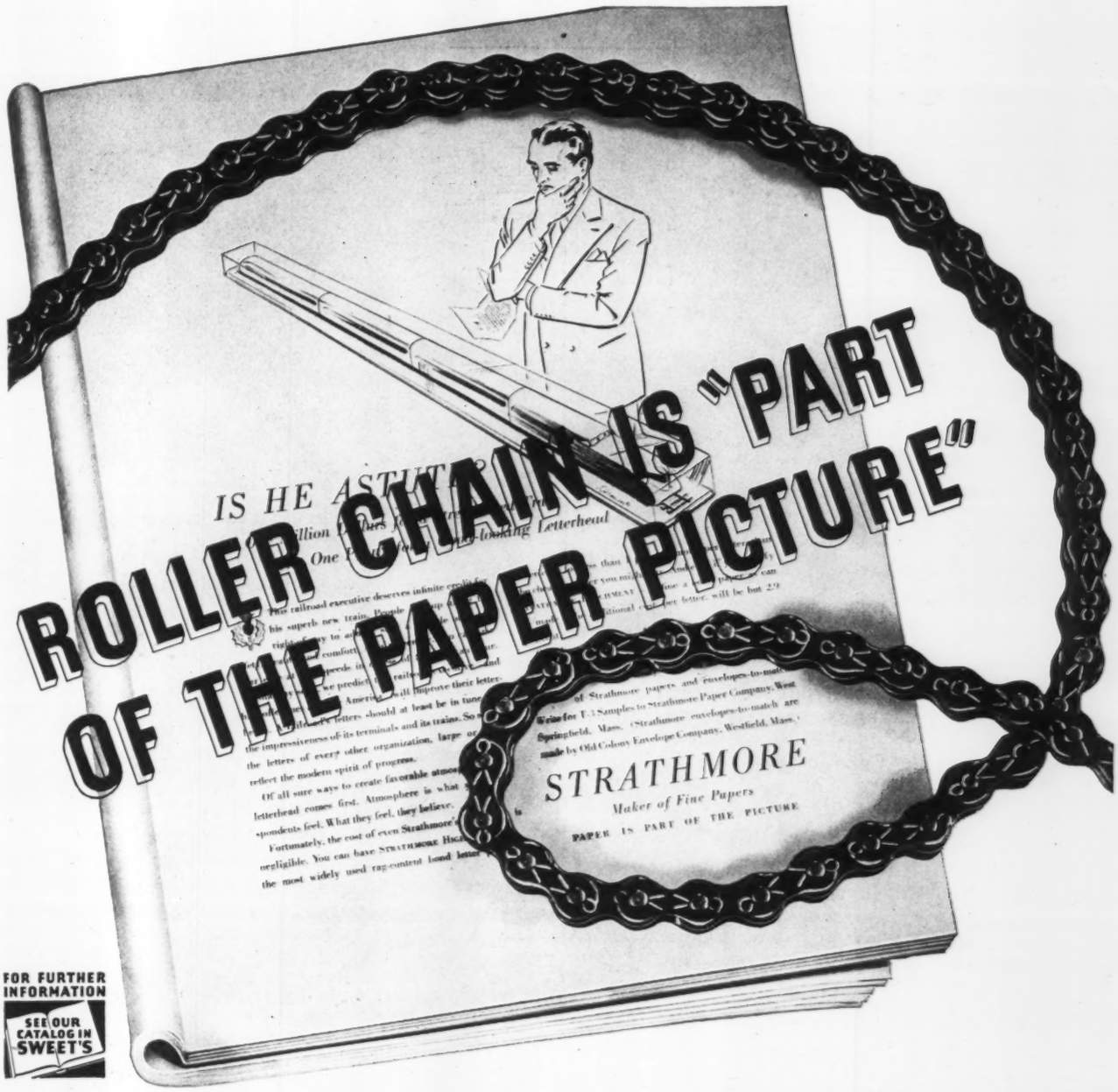


Double-channel construction of this T-square insures rigidity and perfect accuracy

Drawing Board Is of Fiber

MADE of hard, fibrous composition which will not warp or crack, Marber Co., 20 East Jackson street, Chicago, has introduced a drawing board

(*Continued on Page* 86)



FOR FURTHER INFORMATION
SEE OUR CATALOG IN SWEET'S

The making of fine paper is an art—in which every operation must be nicely co-ordinated. Strathmore Paper Company, one of America's best-known manufacturers of fine paper, uses thousands of feet of Baldwin-Duckworth roller chain in its several plants to assure that perfection of operation which is so essential.

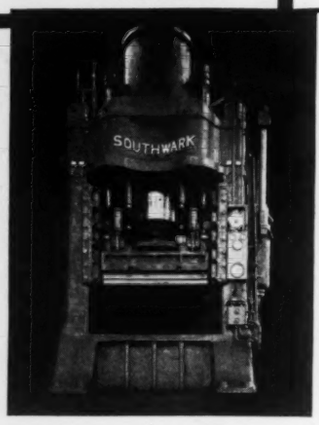
Baldwin-Duckworth roller chain is an important part of the picture in thousands of industries where efficient, economical and reliable operation must be assured. Whatever your power transmission or conveying problem, whether speeds of a few inches a minute or in excess of 3000 feet per minute are needed . . . you may find the right Baldwin-Duckworth roller chain the ideal solution.

Let our engineering department, with its 40 years of experience, help you without obligation.

BALDWIN-DUCKWORTH CHAIN CORPORATION
Springfield, Mass.

BALDWIN DUCKWORTH

A *Battle* WAS LOST FOR WANT OF A *Nail*



THE OLD STORY of the missing horseshoe and the lost battle has its counterpart in modern industry. Even so comparatively small a thing as a single bearing can burn out for lack of adequate lubrication—throwing its own machine, and sometimes even a whole department, completely out of commission.

The net worth of production time lost each year to industry through faulty lubrication can only be estimated but certainly it totals a staggering sum. In one large plant, accurate records reveal that **80%** of *all* lost production was due to lack of lubrication.

Farval Centralized Systems will protect your machine operations at all times against costly delay due to improper lubrication.

Farval is a mechanical method of delivering clean lubricant from a central station under high pressure to a group of bearings, in exact, measured quantities. Operation is constant and positive, *and not a bearing is missed.*

An experienced Farval Engineer will discuss the application of the correct Farval System to the Machines you design and build. The Farval Corporation, 3265 E. 80th St., Cleveland, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Cleveland, Manufacturers of Automotive and Industrial Worm Gearing.

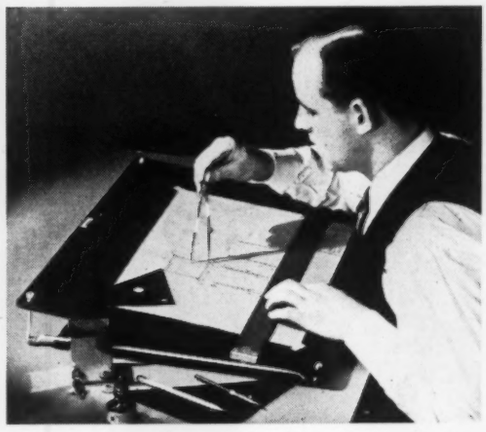
FARVAL

CENTRALIZED SYSTEM OF LUBRICATION

Special Delivery to Every Bearing

(*Continued from Page* 80)

known as the Draw-O-Matic. Light in weight, impervious to water and alcohol, the board is well suited for use in the drafting room or shop. Rubber covered,



Fiber drawing board is not damaged by water, alcohol or ordinary solutions

steel angle supports are provided with the board to give a comfortable drawing position for the draftsman.

Beam Analysis Simplified

(*Continued from Page* 43)

when the value of γ given in equation (19) is substituted in equation (24). Observe that if $\eta = N$ and $Z = I$ this quantity becomes identical with the corresponding straight beam formula which is another case where the form of the expression has been preserved as pointed out in the introduction. Further application of equation (25) yields the solution of many interesting and practical problems.

List of Symbols

A = Area of cross section
a = Length of upper base of trapezoid or triangle
b = Length of lower base of trapezoid or triangle
D = Diameter of circle
E = Modulus of elasticity
e, e_o = Circumferential strain
h = Depth of beam section
h_1 = Distance from gravity axis of trapezoid to lower base
h_2 = Distance from gravity axis of trapezoid to upper base
I = Rectangular moment of inertia
M = Bending moment
N = Normal force
$\eta = N - M/R$
R = Radius of curvature of unstrained beam measured to central axis
ρ = Radius of curvature of beam after strain
S = Stress
v = Distance from central axis to any fiber
Z = Modified moment of inertia
δa = Element of area
γ = Distance from central axis to neutral surface
ϕ, Θ = Angles (see *Fig.* 1)
P = Load in pounds
Σ = Summation of

MEETINGS *and* EXPOSITIONS

Aug. 18-21—

American Society of Mechanical Engineers. Oil and gas power meeting to be held under the joint auspices of the oil and gas power division, the central Pennsylvania section of the society, and the School of Engineering of the Pennsylvania State College, State College, Pa. Meeting at the Pennsylvania State College, State College, Pa. C. E. Davies, 29 West Thirty-ninth street, New York, is secretary.

Aug. 30-Sept. 3—

American Institute of Electrical Engineers. Pacific coast convention to be held in Spokane, Wash. H. H. Henline, 29 West Thirty-ninth street, New York, is in charge.

Aug. 30-Sept. 3—

National Association of Power Engineers. Mississippi valley mechanical and electrical show to be held at Jefferson Hotel, St. Louis. Fred C. Laufketter, chairman of Executive committee, N.A.P.E. is in charge.

Sept. 6-10—

American Mining congress. Annual metal mining convention and exposition to be held at Salt Lake City, Utah. Julian D. Conover, 439 Munsey building, Washington, is secretary.

Sept. 6-10—

British Institute of Metals. Autumn meeting in Sheffield, England. G. Shaw Scott, 36 Victoria street, Westminster, London, S. W. 1, is secretary.

Sept. 6-10—

American Chemical Society. Ninety-fourth meeting will be held in Rochester, N. Y. M. H. Eisenhart, president of Bausch & Lomb Optical Co., is general chairman.

DO YOU NEED A SWITCH for HIGH-SPEED OPERATION?

TYPE FA-6 (metal) TYPE FA-15 (glass)

Here's a new vacuum switch that's particularly adapted for machine applications that demand quick-break, positive action and high-speed operation. Its simple construction and small movement enable it to function rapidly.

Where It Can Be Used

With any mechanism that uses mechanical movement to make, break, or transfer an electric circuit. Particularly applicable to relays, other control devices, all types of machines, thermostats, limit switches, etc.

G-E application engineers will be glad to help you apply them to your requirements.

Operation

This vacuum switch consists of one movable and two stationary contacts sealed in an evacuated glass or metal tube. An operating arm welded to a flexible diaphragm at the top of the tube communicates the movement of the armature to the contacts and provides the motion to make, break, or transfer an electric circuit.

WRITE FOR COMPLETE INFORMATION

General Electric, Dept. 6-201, Schenectady, N. Y.

Please send me a copy of GEA-2657, a descriptive sheet on the new vacuum switches.

NAME.....

ADDRESS.....

CITY..... STATE.....

180-8

GENERAL ELECTRIC

New

LIGHTED PUSH BUTTON

SINGLE BUTTON BOTH CONTROLS and INDICATES

A NEW idea in push-button control, this single button both controls and indicates. Inside the large, convenient button is an indicating lamp that lights the button brilliantly as an indication to the operator.

To the machine designer, this new device means saved space, for one unit takes the place of two. It also means increased sales appeal, for the use of a lighted button in the control is not only novel, but of practical value to the customer.

The push-button element is identical with that ordinarily used in G-E push buttons for machine tool control—a third circuit is added which connects the lamp in the indicating circuit.

We shall be glad to send you information on this new product. Address General Electric Company, Dept. 6-201, Schenectady, New York.

080-127

GENERAL ELECTRIC

MANUFACTURERS' PUBLICATIONS

ALLOYS (NICKEL)—The American Rolling Mill Co., Middletown, O., has just issued a 25-page booklet on "Armco Stainless Steels—Chromium Nickel Grades." Uses of Armco stainless steels in many types of equipment are illustrated.

ALLOYS (NICKEL)—Improvement of plain and nickel alloy cast irons by heat treatment is discussed in a well-illustrated 16-page booklet prepared by The International Nickel Co., Inc., 67 Wall street, New York.

BEARINGS—Johnson Bronze Co., New Castle, Pa., has just released a reference chart giving complete information on the 200 sizes of cast bronze graphited bearings made by the company.

BEARINGS—Revised edition of the conveyor section of the Timken Engineering Journal has been expanded to include other forms of transfer equipment such as belt and pan conveyors, head and tail pulley pillow blocks and pallet wheels. The new section is prepared by The Timken Roller Bearing Co., Canton, O., and is ready punched to fit standard binder furnished with the engineering journal.

BELTS—Chicago Belting Co., 113 North Green street, Chicago, has issued a booklet describing the manufacture and applications of tension welded leather belting. Other products for belt maintenance are included in the booklet.

CHAINS—Catalog V-125 covers prices and specifications of stock and made-to-order sprockets as well as chain data of The Whitney Chain & Mfg. Co., Hartford, Conn.

CONTROLS (ELECTRICAL)—"Diamond H" mercury tube relays and switches are described and prices and specifications given in a bulletin recently issued by The Hart Manufacturing Co., Hartford, Conn.

CONTROLS (ELECTRICAL)—"Built To Endure" is the title of a 16-page brochure just issued by The Mercoid Corp., 4213 Belmont avenue, Chicago, describing thermostats, line safety controls, limit and low water controls for boilers, and other products of the company.

DRIVES—Bearings, pillow blocks, pulleys and other power transmission equipment are described and specified in bulletin D-30-Jr., issued by Dodge Manufacturing Corp., Mishawaka, Ind. Prices are included in the bulletin.

FINISHES—Properties of chip-proof colored flexible lacquer are given in a four-page booklet prepared by Roxalin Flexible Lacquer Co., Inc., Elizabeth, N. Y. Another booklet released by the company describes a "no finger print" taupe finish, No. 978 A, of neutral color which does not show dust or minor defects.

GEARS—Celoron laminated fiber gears are discussed

RACINE

Variable Volume Hydraulic Pump

A thoroughly proven, efficient pump for power transmission.

Capacities—
0 to 2000
0 to 4000
0 to 6000
cu. in. per min.

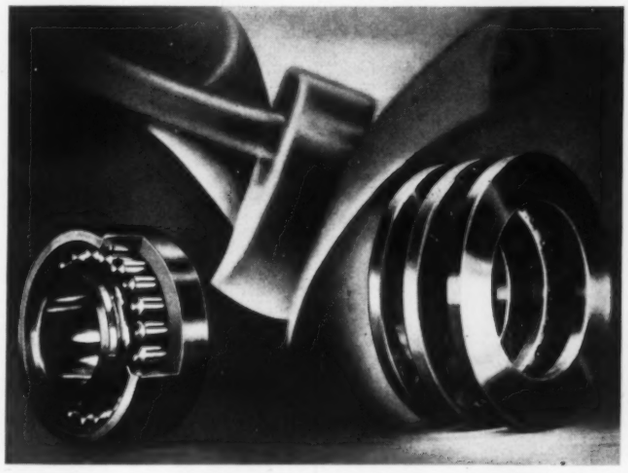
The variable volume feature eliminates by-passing of surplus oil, decreases heating and reduces horse-power requirements. Rated for pressures up to 1000 pounds per square inch.

Successfully applied and proven highly satisfactory on such applications as:

Presses
Die Casting Machines
Welding Machines
Chucking Operations
Machine Tools
Table Movements
Stokers
Conveyors
Broaching Machines
Bending and Rolling Equipment, etc.

A variety of valves and controls are available for standard operations

RACINE TOOL & MACHINE CO.
1773 State St. Racine, Wis.



SPLITTING THE LOAD

When a manufacturer of rubber machinery had to obtain maximum combined carrying capacity in a given space while dealing with enormous but incalculable combinations of radial and thrust loads—he came to ROLLWAY.

We found that maximum capacity called for loads perpendicular to roller surfaces. As a result the ROLLWAY design split the load into pure radial and thrust components. This handles the load with the greatest efficiency and makes the best possible use of a fixed and limited outside diameter. The ROLLWAY performance has been so much superior that it is now *standard* equipment.

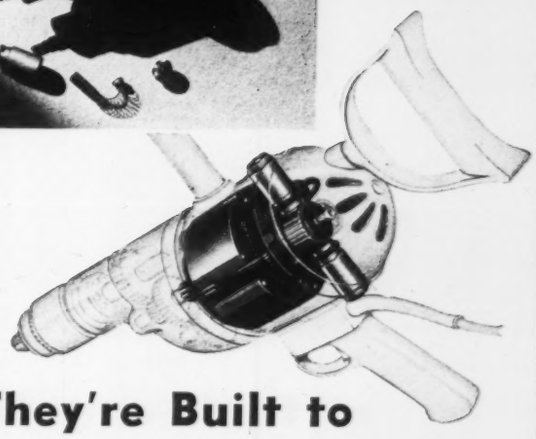
A ROLLWAY Analysis of your bearing problems aims at maximum performance, which only concentrated experience and study in a single field can give.

ROLLWAY BEARING CO., INC., SYRACUSE, N. Y.

MORE THAN JUST MOTOR PARTS

Left—Typical G-E motor parts

Below—A device using such parts



They're Built to Match Your Devices

When you buy G-E motor parts, you get, in addition to the parts, engineering service that means longer-lived devices and satisfied users. G-E engineers have successfully applied high-speed motor parts to such devices as drills, sanders, routers, shapers, reamers, mixers, hammers, saws, and valve seaters. These specialists will be glad to work with you and give you the benefit of their many years of experience in selecting torques, speeds, gear trains, mounting arrangements, and ventilating systems. They may also be able to show you how to save on materials, machining, and assembling.

General Electric offers a complete line of universal series-motor parts in ratings from 1/100 to 1 1/3 hp at speeds from 5,000 to 10,000 rpm, for operation on either alternating or direct current up to 250 volts. For additional information, ask the nearest G-E sales office for GEA-1942, or write General Electric, Schenectady, New York.

070-194

GENERAL ELECTRIC

ATTRACTIVE FACES
for Your Equipment

BUYERS' eyes always focus on the face of your equipment—the instruments. That is why it will pay you to make certain that they are attractive G-E instruments; that they have the G-E accuracy, sturdiness, and sound design. The G-E monogram will tell the buyer that you build with the best in electric equipment. It will mean quicker, easier sales.

For an instrument to fit your equipment, come to

Headquarters for Electrical Measurement

430-97

GENERAL ELECTRIC

in a bulletin which includes specifications and general gear information published by Continental Diamond Fibre Co., Newark, Del.

INSTRUMENTS—Voltmeters, ammeters, and various electrical plugs and sockets are described in catalog section 43-600 issued by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Prices and wiring diagrams are included.

INSTRUMENTS — Thermocouples, pyrometers, selector switches and other electrical equipment are described in a series of leaflets issued by The Lewis Engineering Co., Naugatuck, Conn.

MOTORS—Direct current and slip ring motors manufactured by Century Electric Co., 1806 Pine street, St. Louis, are described in two bulletins recently issued by the company.

PLASTICS—Development of various Bakelite resinous materials, their general characteristics, their properties and applications are given in a booklet released by Bakelite Corp., 247 Park avenue, New York.

PLASTICS—The story of Beetle molded material is told and graphically illustrated in a 50-page book prepared by the Beetle Products Division of the American Cyanamid Co., 30 Rockefeller Plaza, New York. Method of molding, properties of the material and applications are included in the book.

PUMPS—Two bulletins have recently been released by Roots-Connersville Blower Corp., Connersville, Ind., covering their line of rotary pumps for heavy duty. Bulletin 61-B10 lists the RF, three-lobe cycloidal pump and bulletin 55-B10 covers the application of many Roots-Connersville units.

PUMPS—Bulletin No. D-46 issued by Lawrence Pump and Engine Co., Lawrence, Mass., describes and gives specifications of the new Vortex, type SC pump brought out by the company.

RUBBER — Neoprene, an oil-resisting engineering material with rubber-like properties, is described in detail in a new handbook published by Rubber Chemicals Division, E. I. du Pont de Nemours & Co. Specific applications of neoprene, including hose, electrical cable, molded parts, extruded material, sheet goods and gaskets are described.

SHIMS—Adequately illustrated, a 16-page booklet describing the types, uses, and specifications of Laminum, precision adjustment shims, has been issued by Laminated Shim Co., Inc., 21-24 44th avenue, Long Island City, N. Y.

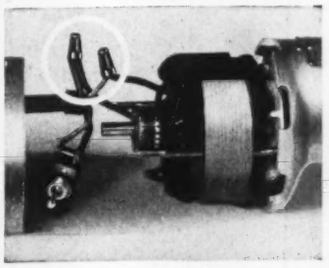
STEEL—Inland Steel Co., 38 South Dearborn street, Chicago, has released a 16-page booklet telling of the applications of 4-way floor plate steel. Illustrations show trucks, tractors, and trailers equipped with the plate among other uses.

WELDED PARTS AND EQUIPMENT—Fourth edition, *Procedure Handbook of Arc Welding Design and Practice,* includes the latest weld symbols adopted by the American Welding Society and a new introduction to part six, "Designing for Arc Welded Steel Construction in Machinery." It is published by The Lincoln Electric Co., Cleveland; and sells for $1.50 in the U. S. and $2 elsewhere.

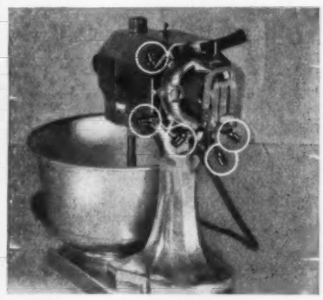
THEY STEP-DOWN COSTS . . . STEP-UP PRODUCTION!

IDEAL WIRE CONNECTORS Solderless Tapeless

Stronger Mechanically — Better Electrically



A *strong*, dependable electric wire-joint that you can count on. Reduces material cost, application time and labor. Leading manufacturers have standardized on their use.



Require no tools . . . just thread on with the fingers.

Unaffected by heat, cold or moisture.

Fully approved — listed by Underwriters' Laboratories.

Send for free samples

LEADING MANUFACTURERS HAVE STANDARDIZED!

IDEAL COMMUTATOR DRESSER COMPANY

1059 Park Avenue Sycamore, Illinois

SPRING WASHERS

Spring washers and lock washers of every type and size, including the well-known Hipower and Kantlink types. There are thousands of more places where spring washers would improve the value of any product where bolts, nuts, cap or machine screws are used.

STEEL ROD ENDS

Drop forgings including steel rod ends of the adjustable yoke, plain yoke, and eye types. These articles in standard sizes and threads afford tremendous savings over special designs.

RETAINING RINGS

Spring retaining rings of special heat-treated spring steel are carried in many stock sizes—both open and closed types. Use of a spring retaining ring is an excellent manner of creating a shoulder on a shaft.

CONTAINER HANDLES

Forged steel handles for heavy containers—can be rigidly welded, riveted or attached by a strap to lie flat when not in use. Rugged and most satisfactory for hard usage.

STEEL BARREL CLOSURES

Forged and machined fittings for steel barrels, drums, tanks and metal packages, including plugs, rings and flanges. Very rugged for use in transportation of alcohol, turpentine, oils and other expensive liquids.

RHEOSTATS—RESISTORS—LOAD BOXES AND SPECIAL APPARATUS

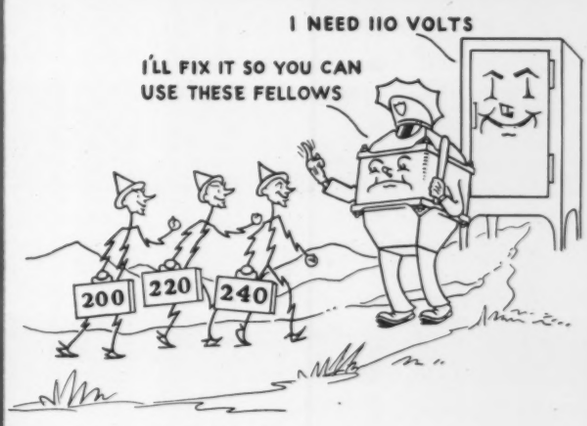
Our electrical division—Hardwick, Hindle, Inc.—makes as fine electrical resistance products, fixed and variable, as can be devised.

Other products include windows for buses and railway cars, railway car window curtains, curtain rollers and fixtures, sash locks and lifts.

THE NATIONAL LOCK WASHER COMPANY

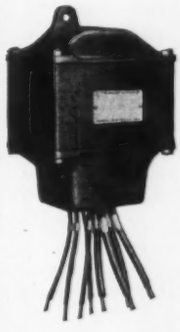
NEWARK, N. J.—EXPORT DIV., 15 E. 26 ST., N. Y. C.

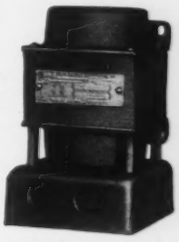
SMALL AUTOTRANSFORMERS PUT SAVINGS "ON ICE"



LAST year one refrigerator manufacturer used more than 2000 small G-E autotransformers for supplying the correct voltage to refrigerators shipped abroad. Voltages vary widely in different parts of the world, but by supplying these transformers, the manufacturer was able to use standard 110-volt, 60/50-cycle motors on the refrigerators he sold. This meant big savings in motor costs and in stock expense.

This is only one of the many ways in which small air-cooled transformers are putting money in the pockets of those who use them. They will supply low voltages from standard circuits—for greater safety in operating portable tools, or for built-in lighting. They will step up the voltage to the proper level at your motors—to improve plant operation. G-E air-cooled transformers can serve you well in a multitude of applications. If you have a problem, let us know. We'll be glad to cooperate. General Electric, Schenectady, New York.





320-74

GENERAL ELECTRIC

Business and Sales Briefs . . . . . .

FOR eleven years vice president of Graton & Knight Co., Worcester, Mass., Frederick E. Barth has been elected president to succeed the late Frank H. Willard. Mr. Barth has served in the capacities of office manager, general sales manager and from 1926 as vice president and assistant general manager.

* * *

Beryl Metals Co., Spokane, Wash., plans the construction of a reduction plant for producing a beryllium alloy of steel, iron and copper.

* * *

According to a recent announcement, General Plastics Co. Inc., Tonawanda, N. Y., plans to build a substantial addition to its present quarters.

* * *

Allis-Chalmers Mfg. Co., Milwaukee, has opened an office at 211 N. Champion street, Youngstown, O. C. H. Legler will have charge of the new office which will operate as a branch of the Pittsburgh district office.

* * *

Harnischfeger Corp., Milwaukee, has appointed Francis Leslie and U. V. Westover as sales engineers in the New York territory, handling its line of P & H Smootharc welders and weld rods.

* * *

Everett D. Graff, first vice president of Joseph T. Ryerson & Son Inc., Chicago, has been elected president. Mr. Graff has been with the company for 31 years, joining it immediately upon graduation.

* * *

Forrest U. Webster, who for years has been advertising manager of Cutler-Hammer Inc., Milwaukee, and for the past three years merchandise sales manager, has resigned to become an executive of the Lord & Thomas advertising agency, New York.

* * *

Distribution of the complete line of "precision-built" motorized speed reducers, rotary converters and blower wheels, manufactured by the Janette Mfg. Co., 556 West Monroe street, Chicago, is being given to the Savage-Girton Co. of St. Paul and Minneapolis.

* * *

Complete arc welding sales and engineering service is being provided by the Lincoln Electric Co., Cleveland, in Sacramento and the central valley of California. William F. Fischer, representative, is located at 1241 Thirty-second street, Sacramento.

* * *

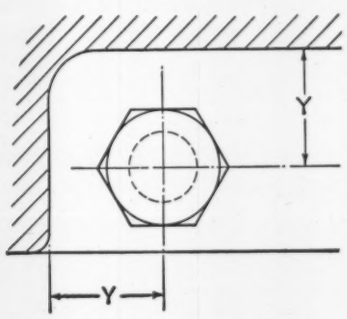
Several new appointments of the Ward Leonard Electric Co., Mount Vernon, N. Y., have recently been announced. For the sale of its motor starters, controllers, contactors and disconnect switches, the Ward Leonard company has appointed Triangle Equipment Co., 50 Church street, New York, and 330 South Jefferson street, Chicago. The New York office will be under the management of R. B. Anderson and will cover the metropolitan area and New Jersey; while the Chicago office will be in charge of R. W. Anderson, covering the territories of Wisconsin, Eastern Iowa, Illinois and Northern Indiana.

Another appointment for the sale of its electric con-

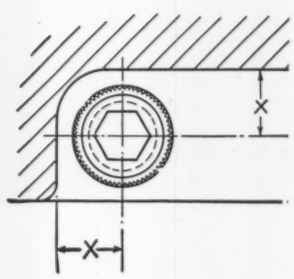
Save SPACE AND WEIGHT BY SPECIFYING UNBRAKO

KNURLED
Socket Head Cap Screws

These drawings are very visible proof of how the use of the Knurled "Unbrako" saves space by fitting closer into corners than can the ordinary hex head bolt. This space saving naturally results in snug, compact designs as well as a reduction of weight, amount of necessary materials and total manufacturing cost as well. These are savings that can be obtained so easily that it will surely pay you to find out more about "Unbrako" as soon as possible.



Notice the great open spaces necessary for the hex-head and wrench.



See how the Knurled "Unbrako" snuggles right into the corner.

Write for complete information and prices . . . and ask, too, how the "UNBRAKO" can be locked, quickly and easily. No obligation.

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JENKINTOWN, PENNA.
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. . . by telling YOUR requirements to US.

Often, from our extensive line, we can adapt STOCK PARTS for the user's benefit.

What are your pump needs?

Brown & Sharpe Mfg. Co.
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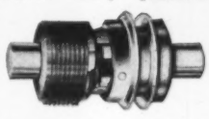
B·S

Use PULLMORE CLUTCHES

for HEAVY LOADS, 24 HOUR SERVICE



Pullmore Clutches are made in single and double types, for operation in oil or dry, in capacities up to 75 h.p.

Illustrated is a Howell Industrial Truck in which a single type Pullmore Clutch, operating dry, is used to raise and lower the load. In many of these trucks Pullmore Clutches are subjected to heavy loads, hard service 24 hours a day; and it hasn't been necessary to replace a Pullmore in the several years of Howell experience. If you manufacture trucks, cranes, machine tools; or similar equipment—use Pullmore Clutches, they are reliable, efficient, durable, economical. Investigate. Write today for complete information.

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Borg-Warner Corporation, 304 Catherine Street, Rockford, Illinois

Sold by Morse Chain Co., Ithaca, N. Y. With offices in principal cities

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*Title*_____

trol devices has been made—that of Brance-Krachy Co., 4411 Navigation boulevard, Houston, Tex., covering the southeastern portion of Texas.

John S. Clark, Postoffice Box 143, Station A, El Paso, Tex., will handle the sale of these devices in the eastern half of Arizona, New Mexico and the western portion of Texas.

* * *

E. W. Ferry Screw Products Inc., Cleveland, has recently been incorporated. Thomas W. Kennedy, Guarantee Title Building, Cleveland, is correspondent.

* * *

Formerly with Lincoln Electric Co., G. W. Hoskins has joined the Harnischfeger Corp., Milwaukee, as sales manager for the Smootharc welder and weld rods in the Philadelphia territory.

* * *

Murray J. Whitfield, formerly manager of sales, electrical division of Steel & Tubes Inc., Chicago, has been appointed general sales manager of Appleton Electric Co., Chicago.

* * *

Dave Wilkus, who for the past twenty years has been actively engaged in the sale of motors, has now transferred his affiliation to the Harnischfeger Corp., Milwaukee, in the capacity of sales engineer for the P & H line of slip-ring and squirrel-cage motors. He will represent the company in metropolitan Chicago.

* * *

H. F. Boe has been appointed new commrecial manager of Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. He will have two headquarters, one in the Union Bank building, Pittsburgh, and the other at 150 Broadway, New York. Mr. Boe, in addition to being responsible for the sale of Westinghouse products in the Eastern district, will now direct the commercial activities of the apparatus divisions.

* * *

William Printz, 45 West Thirty-fourth street, New York, has been named sales manager for the Eastern division of Wheelco Instruments Co., Chicago, maker of temperature indicating and control instruments.

* * *

D. G. Phelps, associated with the Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., since his graduation in 1902, has been promoted to the position of vice president of the company in charge of electrical division.

* * *

Allen-Bradley Co., Milwaukee, has appointed the Nickerson Machinery Co., 110 West Second South street, Salt Lake City, to handle its line of motor control equipment in Utah, Southern Idaho, and Western Wyoming. Mr. A. C. Nickerson is in charge.

* * *

C. W. Gilmer, heretofore manager of mechanical sales in the Seattle branch of the United States Rubber Products Inc., as been transferred to the New York office as belting sales engineer. L. F. Koepp, formerly salesman in the Seattle district, will take Mr. Gilmer's place.

* * *

Mercoid Corp., 4213 Belmont avenue, Chicago, has transferred Bassett Lerch from the Chicago office to St. Louis, with headquarters at 8787 Bridgeport avenue. Russell MacDonald is now located in the Boston office of the company, and Paul Provost is with the Philadelphia office.

For NERVOUS MACHINES

Rx

UNSHAKO

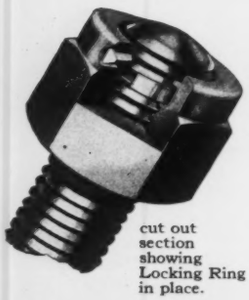
The Nut That Can't Shake Loose

Vibration is licked when it meets "Unshako" . . . the ingenious self-locking ring, built right in the nut, holds it tight against the severest shaking and jarring, yet with an ordinary wrench it backs off without a murmur.

There are no separate washers, pins or parts to bother with.

This nut, though new in principle, has successfully proven every claim in almost every type of industry where vibration has been at its worst.

Write for complete information.



Pat'd. and Pat's. Pending Fig. 1510

cut out section showing Locking Ring in place.

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that Keep a man busy with a wrench

WHAT CAN I DO TO MAKE THEM THINK?

By Robert F. Heller †

What executive hasn't asked himself that question over and over again? Your business could forge ahead more rapidly if you could get more of your employes to do a thinking job — but how? The five steps outlined in this article supply the answer that all business is seeking today!

WHEN an employe sticks his head in the door and asks a question that one second of thought would have answered for him, does it "burn you up"?

When a man in the machine shop "gums" the works on an important job because he "didn't know", do you see red?

When you have to spend all your time thinking out shop problems or finding short cuts, are you doing your job or someone else's?

The day when one or two men can do all the thinking for an organization has definitely passed. Business has grown too complex, too intricate, for the heads of a business to be able to do the thinking on every individual operation throughout the plant. Important phases of management, selling and finance may command the bulk of your business hours. The thinking you are doing is along broad creative lines. You are the architect building a business; your key employes are the contractors and subcontractors.

Yet, one idea from an employe — one well thought-out suggestion—may profitably improve the whole design of your business structure. How can you get these men to offer ideas and suggestions? How can you make them think?

Have you ever stopped to analyze what makes you think and what has influenced the new ideas you have developed for your firm during the past 10, 15 or 25 years?

Suppose in all that time you had never seen a business paper, had never read an article related to your business, never analyzed your production setup in comparison with others described from time to time, never picked up a short cut or money-saving idea from a trade paper, and never had looked at a helpful piece of direct mail advertising. In short, suppose during your entire business career you had never done any reading related to your business. How do you suppose it would have affected your thinking?

Would your plant and methods be as modern as they are right now? Would you know all the things you know today if you had not done your share of reading during those years of building?

The answer is obvious. Reading does exercise a powerful influence on our thinking. It stimulates us from outside of ourselves. It pours ideas into our minds that tumble around and take shape, to our benefit and profit. It spurs us on, shows us new and easier ways of doing things and encourages us to think and apply the things we read.

What's sauce for the goose is sauce for the gander, yet how many of your key men realize, as you do, the importance of reading publications that deal with your business and their jobs?

Would you really like to know? Then take time out to make a little survey. Ask each key man, right down to your foremen, about his reading habits. Find out what business papers

†Beaumont, Heller & Sperling, Inc.—Reading, Pa.